

June 25, 1997

Mr. Nicholas J. Liparulo, Manager  
Nuclear Safety and Regulatory Activities  
Nuclear and Advanced Technology Division  
Westinghouse Electric Corporation  
P.O. Box 355  
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SUBJECT: STAFF UPDATE TO DRAFT SAFETY EVALUATION REPORT (DSER) OPEN ITEMS  
(OIs) AND REQUESTS FOR ADDITIONAL INFORMATION (RAI) REGARDING THE  
WESTINGHOUSE AP600 INITIAL TEST PROGRAM (ITP)

Dear Mr. Liparulo:

As a result of recent efforts by the U.S. Nuclear Regulatory Commission staff, the status of several DSER OIs and RAIs has changed and additional information needed to complete the review has been identified. Enclosed are the status of the OIs related to the ITP, and the staff's evaluations of these open items.

Please update the open item tracking system database to reflect this information. If you have any questions regarding this matter, you can contact me at (301) 415-1132.

Sincerely,

originals signed by:

Joseph M. Sebrosky, Project Manager  
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Office of Nuclear Reactor Regulation

Docket No. 52-003

Enclosure: As stated

cc w/encl: See next page

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Docket No. 52-003  
AP600

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## Westinghouse AP600 SSAR Chapter 14, Initial Test Program

**Background:** By letters dated March 20, 1997, the staff provided Westinghouse with the results of the its review of all outstanding AP600 Standard Safety Analysis Report (SSAR) Chapter 14, Initial Test Program open items (93) being tracked in the AP600 Open Item Tracking System (OITS). This letter also included additional requests for additional information (RAIs) as a result of the staff's review of Revision 11 to the SSAR, Chapter 14. Subsequently, by letter dated May 14, 1997, the staff forwarded followon RAIs related to the Containment Systems Branch scope of Chapter 14 review.

By letters dated May 9, 1997, and June 11, 1997, Westinghouse provided its response to the staff's March 20, 1997, and May 14, 1997, letters, respectively. Revision 13 (dated May 30, 1997) of the SSAR, Chapter 14, submitted by Westinghouse on June 11, 1997, incorporated the proposed SSAR changes proposed by Westinghouse in its May 9, 1997, and June 11, 1997, letters to the staff.

Therefore, this review encompasses the acceptability of changes incorporated in Chapter 14 as a result of Revision 13 to the SSAR as well as the review status of RAIs for which Westinghouse has not yet proposed a response.

□ **OITS 780/DSER Open Item 3.9.2.1-1:** In the DSER, the staff found that in order to be consistent with the guidance in Subsection 3.9.2 of the SRP, the systems to be monitored during preoperational vibration and dynamic effects testing tests should include:

- ASME Code, Class 1, 2, and 3 piping
- high-energy piping systems inside Seismic Category I structures
- high-energy portions of systems whose failure could reduce the functioning of Seismic Category I plant features to an unacceptable safety level
- Seismic Category I portions of moderate-energy piping systems located outside the containment

In partial response to DSER Open Item 3.9.2.1-1, Revision 4 to the SSAR revised Subsection 3.9.2.1 to add a commitment to include all of the piping systems listed above in the AP600 piping vibration, thermal expansion, and dynamics effects testing programs. Additionally, in its August 13, 1996, response to the NRC, Westinghouse stated that "Subsection 14.2.9.1.7, has been revised to state that the AP600 preoperational piping vibration, thermal expansion, and dynamics testing will include ASME Code Class 1, 2, and 3; i.e., safety related high energy piping system components, piping, and piping support and restraint devices."

Enclosure

Therefore, in Revision 11 of SSAR Chapter 14, Section 14.2.9.1.7, under "General Test Method and Acceptance Criteria," only ASME Class 1, 2, and 3 piping systems will be tested. Sections 14.2.10.4.18 and 14.2.10.4.25 contain a broad commitment to test "essential NSSS and balance of plant components." Therefore, in order to remain consistent with SRP 3.9.2 and SSAR Section 3.9.2.1, Westinghouse needs to revise Sections 14.2.9.1.7, 14.2.10.4.18 and 14.2.10.4.25 to include a commitment that the four types of systems listed above will be monitored during piping thermal expansion, vibration, and dynamic effects testing. Therefore, the Chapter 14 part of DSER Open Item 3.9.2.1-1 remained open.

In its May 9, 1997, response to the staff, Westinghouse proposed that SSAR Section 14.2.9.1.7 be revised to include the following criteria for selection of systems to be tested:

The systems to be monitored during preoperational vibration and dynamic effects tests include:

- ASME Code, Class 1, 2, and 3 piping
- high-energy piping systems inside Seismic Category I structures
- high-energy portions of systems whose failure could reduce the functioning of Seismic Category I plant features to an unacceptable safety level
- Seismic Category I portions of moderate-energy piping systems located outside the containment

Westinghouse also stated that the Dynamic Response test (14.2.10.4.18) and Thermal Expansion test (14.2.10.4.25) are startup tests and are a repeat of the tests conducted on the systems that meet the criteria for inclusion in test 14.2.9.1.7 (conducted during preoperational testing) for those portions of these systems whose conditions during power operation are sufficiently different than during the testing conducted under 14.2.9.1.7. Section 14.2.10.4.18 and 14.2.10.4.25 would be revised to explicitly reference 14.2.9.1.7.

The staff confirmed that Westinghouse has revised pre-operational test Section 14.2.9.1.7, "Expansion, Vibration, and Dynamic Effects Testing," to include the additional systems as requested. Startup test Sections 14.2.10.4.18, "Dynamic Response," and 14.2.10.4.25, "Thermal Expansion," have been revised to require testing for those portions of systems that meet the test selection criteria for 14.2.9.1.7, but were not tested during the pre-operational test phase because system conditions during hot functional testing were not prototypical. Sections 14.2.10.4.18 and 14.2.10.4.25 have also been revised to include reference to SSAR Section 3.9.2 for appropriate performance criteria. The staff finds this response acceptable and, therefore, OITS 780/DSER Open Item 3.9.2.1-1 is closed.



- OITS 1124/DSER Open Item 9.5.1.4-7: In Subsection 9.5.1.4.8, "Preoperational Testing," of the DSER, the staff found that additional information was required from Westinghouse to establish the acceptability of the fire protection system(s) preoperational test program in complying with Section C.4.e of BTP CMEB 9.5-1. This issue was identified as DSER Open Item 9.5.1.4-7.

In its August 13, 1996, response to the NRC, Westinghouse stated that "Subsection 14.2.9.2.8, Fire Protection System Testing, has been revised to state that the system operates as specified in Subsection 9.5.1 and in appropriate design specifications. These documents identify the applicable NFPA standards for the testing of individual components in the fire protection system. Subsection 14.2.9.2.19 and 14.2.9.4.13 describe testing of the plant lighting and communication systems, respectively. The breathing apparatus provided at the plant and the use of this equipment will be identified by the COL applicant, as part of the fire protection personnel training."

In Revision 11 to the AP600 SSAR Chapter 14, Subsection 14.2.9.2.8, "Fire Protection System Testing," under "General Test Method and Acceptance Criteria," Westinghouse stated "The following testing demonstrates that the system performs its defense-in-depth functions specified in Subsection 9.5-1 and as specified in appropriate design specifications:

The capability of the seismic standpipes to supply the required fire water quantity and flow rate is verified."

The staff disagrees with Westinghouse's conclusion that verifying that the seismic standpipes can supply the required fire water quantity and flow rate demonstrates that the fire protection system "performs its defense-in-depth functions specified in Subsection 9.5-1 and as specified in appropriate design specifications". Westinghouse needs to modify this subsection to encompass testing of the AP600 fire protection system in an integrated manner, i.e., fire doors, fire dampers, smoke control systems, automatic fire detection underground fire main, fire pumps, automatic suppression systems, electrical isolation devices for non-safety related equipment in opposite divisional fire areas, and trained fire brigade. This is to insure that a strong and reliable fire protection program is available to fight, contain and extinguish any type of fire prior to fuel load.

Additionally, Westinghouse needs to incorporate the other subsystems in the Initial Test Program to insure:

- (1) Fire detection will be available to detect fires in their incipient stage and alert key personnel of fire conditions.
- (2) Fire Barriers, fire walls, fire dampers and smoke control systems limit spread of fire and smoke.

- (3) Fire pumps, underground fire main and water supply system will be available to provide a strong water supply to fight fires in safety related areas and non-safety related areas.
- (4) Fire Brigade will be adequately trained to fight fires including electrical and flammable liquid type fires.

The integration of these systems ensures a strong Defense-in-Depth system that provides an acceptable level of fire protection for the AP600 Advance Reactor. Therefore, OITS 1124/DSER Open Item 9.5.1.4-7 remained open.

In its May 9, 1997, response to the staff, Westinghouse proposed that SSAR Section 14.2.9.2.8 be revised to incorporate the NRC comments with the following exceptions:

- (a) the training of the Fire Brigade is the responsibility of the COL applicant as specified in SSAR Section 9.5.1.6
- (b) the AP600 fire protection system does not contain smoke control equipment

Although the changes to Section 14.2.9.2.8, "Fire Protection System Testing," of Chapter 14 that address testing of fire detection, barriers, and fire water supply systems are acceptable, the staff concludes that the Westinghouse response does not address all of the issues raised in the NRC's request. Specifically, Westinghouse has not addressed testing of automatic suppression systems or electrical isolation devices for non-safety related equipment in opposite divisional fire areas. Therefore, OITS 1124/DSER Open Item 9.5.1.4-7 remains open.

□ OITS 1162/DSER Open Item 10.4.7-1(RAI 410.263):

In the DSER, the staff found that Westinghouse should provide procedures for testing feedwater hammer occurrence. Westinghouse responded in their August 13, 1996, letter that Section 14.2.9.1.7, "Expansion, Vibration and Dynamic Effects Testing," was revised to include testing to start/stop startup feedwater to the steam generators to verify that unacceptable feedwater hammer does not occur. Staff review of this section determined that it does not provide sufficient information for testing feedwater hammer occurrence. Additionally, Section 14.2.9.2.2, "Main and Startup Feedwater System," should be modified to include the following:

- a) Perform FW system test and monitor that no effects due to water hammer are detected.
- b) Check for water hammer noise and vibration using suitable instrumentation.

- c) Visual inspection indicates that the integrity of FW piping, support, and feeding have not been violated.

Therefore, OITS 1162/DSER Open Item 10.4.7-1 remained open.

In its May 9, 1997, response to the staff, Westinghouse proposed to include testing of dynamic events (e.g. water hammer) for all applicable systems in Section 14.2.9.1.7.c (including applicable portions of main and startup feedwater piping) to address the NRC comments.

The staff confirmed that Westinghouse has revised Section 14.2.9.1.7, "Expansion, Vibration, and Dynamic Effects Testing," to specifically address the testing, monitoring and visual inspection for the effects of water hammer on the feedwater system as requested. However, these changes will be evaluated in conjunction with Westinghouse's pending response to RAI 410.263. Therefore, OITS 1162/DSER Open Item 10.4.7-1 (RAI 410.263) remains open.

- OITS 1234/DSER Open Item 14.2.1-1 is closed. Closure of this item was documented in the staff's March 20, 1997, letter to Westinghouse.
- OITS 1236/DSER Open Item 14.2.2-2: In the DSER, the staff found that Section 14.2.2 of the SSAR should be revised to clarify that Westinghouse will provide the COL applicant with scoping documents (i.e., preoperational and startup test specifications) containing testing objectives and acceptance criteria applicable to Westinghouse's scope of design responsibility. Such documents should also include, as appropriate, delineation of the following testing information: (a) specific plant operational conditions under which the tests will be conducted, (b) testing methodologies to be used, (c) specific data to be collected, (d) acceptable data reduction techniques, and (e) any reconciliation methods needed to account for test conditions, methods, or results (if testing is performed at conditions other than representative design operating conditions).

The staff also found that this section (and/or Section 14.2.9, as appropriate) should include the following COL action items to be provided by the prospective COL applicant for staff review: (a) the scoping document (i.e., preoperational and startup test specifications) containing testing objectives and acceptance criteria applicable to Westinghouse's scope of design responsibility. This was identified as COL Action Item 14.2.2-1; (b) the scoping document, and any related documents, which delineate plant operational conditions at which tests are to be conducted, testing methodologies to be utilized, specific data to be collected, and acceptable data reduction techniques to be utilized. This was identified as COL Action Item 14.2.2-2; (c) the scoping document that delineates any reconciliation methods needed to account for test conditions, methods, or results if testing is performed at conditions other than representative of design operating conditions. This was identified as COL Action Item 14.2.2-3; and (d) the approved preoperational test procedures (to be provided approximately 60 days

before their intended use, and startup test procedures (to be provided approximately 60 days before fuel loading). This was identified as COL Action Item 14.2.2-4 (These issues were previously identified by the staff in Q260.24). This was identified as Open Item 14.2.2-2.

In its August 13, 1996, response to the NRC, Westinghouse stated that "Information to be provided by the COL, related to the plant initial test program, has been added to the SSAR in Section 14.4." Although not specifically acknowledged in this response, Westinghouse's previous response to Q260.24 was provided in their July 22, 1994, letter to the NRC. In this letter, Westinghouse had stated, in part, that "It is inappropriate for the SSAR to specify the specific form the designers and/or equipment suppliers must supply the information. The optimum form may evolve with information technology and lessons learned from initial plants."

In its November 8, 1996, response to Westinghouse, the staff stated that SSAR Section 14.4, "Combined License Applicant Responsibilities," Subsections 14.4.2, "Test Specifications and Procedures" and 14.4.3, "Conduct of Test Program" both assert that the COL applicant is responsible for (1) providing test procedures for the preoperational and startup tests for NRC review, and (2) formulating the startup administration manual (procedure) which contains the administration procedures and requirements that govern the activities associated with the plant ITP, as identified Subsection 14.2.3, "Test Procedures."

However, the staff noted that Subsection 14.2.3 does not address the responsibility of the COL applicant in preparing the following: (a) the scoping document (i.e., preoperational and startup test specifications) containing testing objectives and acceptance criteria applicable to Westinghouse's scope of design responsibility, and (b) the scoping document that delineates any reconciliation methods needed to account for test conditions, methods, or results if testing is performed at conditions other than representative of design operating conditions. *(These COL applicant areas of responsibility are stipulated under Subsection 14.2.3, "Test Procedures," Section 14.2, "Specific Information to be Included in Final Safety Analysis Reports," of Regulatory Guide 1.70, "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants," Revision 3).*

The staff also clarified that the purpose of Q260.24 and Q260.28 was not to dictate or specify the "specific form the designers and/or equipment suppliers must supply the information." Rather, the issue at hand is the need to explicitly identify and define specific documented information (i.e., "scoping documents" as defined above) that the prospective COL applicant must provide for staff review. Therefore, these portions of DSER Open Item 14.2.2-2 remained open.



In its December 6, 1996, response, Westinghouse stated the following:

"Section 14.2.3 will be retitled - test specifications and Procedures. The contents of current 14.2.3 as currently written applies to either Test Specs or Test Procedures (or both). Test Procedures will be modified to read test specifications and/or Procedures where appropriate. A paragraph describing the contents of the test specifications will be provided which includes:

'Criteria for test results evaluation and reconciliation methods and analysis as required.'

Test specifications or test procedures for each test performed during the ITP include testing objectives and acceptance criteria for each test." (Proposed SSAR Revision: Pages 14.2-4 and 14.2-5).

The staff found that the proposed SSAR revisions, while providing needed clarification and aiding in the resolution of other issues, do not address the COL applicant issues identified in items (a) and (b), above. Therefore, DSER Open Item 14.2.2-2 remained open.

In its May 9, 1997, response to the staff, Westinghouse proposed that SSAR Section 14.2.3 be revised to state:

"Test specifications and procedures are developed and reviewed by personnel with appropriate technical backgrounds and experience. This includes the participation of principal design organizations in the establishment of test performance requirements and acceptance criteria. Specifically, Westinghouse will provide the combined license applicant with scoping documents (i.e., preoperational and startup test specifications) containing testing objectives and acceptance criteria applicable to its scope of design responsibility."

Westinghouse also proposed that Section 14.4.2 be revised to include "test specifications" to be consistent with Section 14.2.3. Performance of corrective actions and re-tests, as required, is included in Section 14.4.4 as the responsibility of the combined license applicant.

The staff confirmed that Westinghouse has revised Section 14.2.3 of Chapter 14 to delineate the responsibility of the principal design organizations to provide pre-operational and startup TS or scoping documents applicable to their scope to design responsibility. In addition, Sections 14.2.3 and 14.4.4 contain the requisite provisions for test review and acceptance. Therefore, OITS 1236/DSER Open Item 14.2.2-2 is closed.

- OITS 1238/DSER Open Item 14.2.2.2-1 is closed. In the staff's March 20, 1997, letter to Westinghouse, this item was documented as confirmatory pending closure of OITS 1236/DSER Open Item 14.2.2-2, above.



□ OITS 1244/DSER Open item 14.2.8-6(RAI 260.26):

In the DSER, the staff found that Westinghouse should provide testing of the main control room (MCR) emergency habitability system on subsequent AP600 plants. Westinghouse responded in their August 13, 1996, letter that Section 14.2.9.1.6, "Main Control Room Emergency Habitability System Testing," was revised to include appropriate testing for each plant, but that a long-term demonstration of this system would be conducted only for the first plant.

Staff review of this section determined that sufficient assurance does not exist to conclude that the heat loads in the MCR area are identical for all AP600 plants. Therefore, Section 14.2.9.1.6 should be modified to include applicability of this testing to subsequent AP600 plants, or Appendix 1A in the SSAR should provide appropriate justification for this exception to RG 1.68, Appendix A, Item 1.n.(14)(f). OITS 1244/DSER Open Item 14.2.8-6 remained open.

The AP600 does not provide active, safety-related HVAC for the MCR, I&C equipment rooms, and Class 1E dc equipment rooms. The habitability of the MCRs is provided by operation of the MCR emergency habitability system, and by the passive heat sinks associated with the MCR structure. Likewise, the environmental conditions that the qualified I&C equipment and Class 1E equipment will be exposed to are based on the passive heat sinks associated with the building and structures that house this equipment.

In its May 9, 1997, response to the staff, Westinghouse stated the following:

"In the AP600, a design basis heatup analysis of the MCR, I&C equipment rooms, and Class 1E dc equipment rooms is performed, and the results are discussed in SSAR Section 6.4. This analysis assumes maximum bounding heat loads for the equipment that could be located in the MCR and equipment rooms. The AP600 Certified Design Material (CDM) for the MCR Emergency Habitability System (Section 2.2.5, Item 8c, and Item 8c in Table 2.2.5-4) specifies that an evaluation will be performed using as-built information and heat loads from installed equipment for the i) MCR, ii) I&C equipment rooms, iii) Class 1E dc equipment rooms. In addition, this evaluation considers the as-built passive heat sinks associated with these rooms, as specified in CDM Section 3.3, Nuclear Island Building Structures. The acceptance criteria for this heat sink capacity analysis results are that: i) the temperature rise for the MCR is less than or equal to 15° F for the 72-hour period; ii) the maximum temperature for the 72-hour period for the I&C rooms is less than 125° F; iii) the maximum temperature for the 72-hour period for the Class 1E dc equipment rooms is less than or equal to 125° F.

This evaluation ensures that the as-built information for the pertinent buildings and structures, as well as the as-built MCR equipment and I&C

and Class 1E head loads are less than that assumed in the design basis heatup analysis for the MCR and the safety-related equipment rooms noted.

The first plant only test specified in 14.2.9.1.6 is a test of the long-term heatup characteristics of the MCR, I&C and Class 1E equipment rooms. It is performed to demonstrate the heatup characteristics of these rooms when they are subjected to a known heat load. This test can be used to provide data for comparison to the design basis analyses. However, testing is not required on subsequent plants, since these plants are required to be built to the requirements specified in the CDM. As a passive heatup of these rooms is not dependent on the proper operation of a system, but is rather a function of the heat loads and passive heat sinks provided in the design, a verification of these parameters (via the ITAAC process) is sufficient to verify the safety of an AP600 built to the specifications contained in the Certified Design Material."

#### Proposed AP600 SSAR Changes

An exception to RG 1.68, Appendix A, Item 1.n.(14)(f) has been added to SSAR Appendix 1A that states this test needs to be performed for the first plant only provided the design basis heat loads used as assumptions in the heat sink capacity analysis bound the actual as-built information and heat loads.

The staff is evaluating Westinghouse's proposal to perform first-plant-only testing of long term performance of the main control room habitability system on the basis that requirements in the CDM provide adequate assurance that future plants will comply with the design and performance requirements of the first plant. However, during preliminary discussions on this issue, Westinghouse was informed that a "first-plant-only" test approach is unacceptable.

While the staff agrees that "The ability of the habitability system to maintain the MCR environment as well as temperatures in the protection and safety monitoring system cabinet and emergency switchgear rooms during a long term loss of the nuclear island nonradioactive ventilation system *may be verified with a limited duration test* [emphasis added]." The staff does not agree that such testing: (1) is so impractical or burdensome that it should be performed on the first plant only, (2) should not include specific verification and duration acceptance criteria. Therefore, OITS 1244/DSER Open Item 14.2.8-6 (RAI 260.26) remains open.

- OITS 1245/DSER Open Item 14.2.8-7: In the DSER, the staff found that in startup test Abstract 14.2.8.2.34, Westinghouse had taken exception to RG 1.68 for testing natural circulation as had been done for current pressurized water reactor (PWR) plants. The justification for this exception was that the performance of a natural circulation test was not necessary to demonstrate flow characteristics of the plant. The

physical layout of the plant and key components (steam generators, pumps, piping, and reactor vessel) remain identical for each unit. Typical manufacturing and construction variations in these parameters would have no significant impact on the natural circulation flow. Since the design and layout is fixed between each AP600 plant, no changes in the natural circulation characteristics would occur. Other system flow and performance measurements taken during the hot functional and power ascension testing would provide assurances that the overall flow characteristics of the plant are equivalent to the reference plant. Therefore, demonstration of the natural circulation characteristics on the first AP600 plant would be sufficient to validate the design characteristics. The natural circulation test is prototypical.

The staff found this response would be acceptable for startup test Abstract 14.2.8.2.34, provided that the following criteria were met: (1) Appropriate justification for this exception to RG 1.68, Appendix A, Item 4.t, is included in Appendix 1A of the SSAR, or Section 1.9.3 of the SSAR, as appropriate. (This justification should provide appropriate reference to Westinghouse's response for NUREG-0737, action item I.G.1, as described in the attachments to the letter from Westinghouse (E.P. Rahe) to the NRC (H.R. Denton), dated July 8, 1981); and (2) Westinghouse identifies this issue, in Section 14.2.9 of the SSAR (or its subsequent equivalent), as a COL action item, which will require COL applicants referencing the AP600 design to perform the following: (a) demonstrate that the physical layout and configuration of the proposed plant and key components (steam generators, pumps, piping, and reactor vessel) remain identical to the reference plant; (b) validate the acceptance criteria, provided by Westinghouse, for the specific values or ranges of values for other system flow and performance measurements that are to be taken during the hot functional and power ascension testing to confirm that the overall flow characteristics of the proposed plant are equivalent to the reference plant. This was identified as COL Action Item 14.2.8-1 and as Open Item 14.2.8-7.

In its August 13, 1996, response to the NRC, Westinghouse stated that "Section 14.3 provides reference to CDM which commits the COL to conduct the Initial Test Program. As part of that Initial Test Program, the COL will verify the physical layout and configuration of the components, and component parameters important to the natural circulation of fluid in the reactor coolant system. These verifications will establish that AP600 plants subsequent to the first plant, will achieve natural circulation flow similar to the flow demonstrated by testing in the first plant."

In its November 8, 1996, response to Westinghouse, the staff clarified that while the CDM provides that the COL conduct certain testing to satisfy ITAAC requirements, the CDM does not commit the COL to conduct the ITP. § 50.34, Appendix A to 10 CFR Part 50, and Section XI, "Test Control," of Appendix B to 10 CFR Part 50 require that a test program be established to ensure that structures, systems, and components will perform satisfactorily in service.

In order to address the staff's concerns on this issue, Westinghouse would need to (1) confirm that the ITAAC process will (a) demonstrate that the physical layout and configuration of the proposed plant and key components (steam generators, pumps, piping, and reactor vessel) remain identical to the reference plant; (b) validate the acceptance criteria, provided by Westinghouse, for the specific values or ranges of values for other system flow and performance measurements that are to be taken during the hot functional and power ascension testing to confirm that the overall flow characteristics of the proposed plant are equivalent to the reference plant; and (2) include appropriate justification for this exception to RG 1.68, Appendix A, Item 4.t, in Appendix 1A of the SSAR, or Section 1.9.3 of the SSAR, accordingly. (This justification should provide appropriate reference to Westinghouse's response for NUREG-0737, action item I.G.1, as described in the attachments to the letter from Westinghouse (E.P. Rahe) to the NRC (H.R. Denton), dated July 8, 1981); otherwise, Westinghouse should commit to performing the requisite natural circulation testing in accordance with RG 1.68, Appendix A, Item 4.t. DSER Open Item 14.2.8-7 remained open.

In its December 6, 1996, response, Westinghouse stated the following:

"Section 3.4 of the AP600 CDM as submitted for staff review on November 8, 1996, contains a high level commitment to perform an Initial Test Program by the COL applicant."

Justification for this exception will be provided in Appendix 1A of the SSAR citing the appropriate reference and stating the rationale:

'For the AP600, natural circulation heat removal is not safety-related, as in current plants. This safety-related function is performed by the PRHR. Natural circulation heat removal via the PRHR is tested for every plant. Therefore, Westinghouse has met the intent of the previous licensing commitments for natural circulation testing.'

This justification will be provided in Section 1.9.3 of the SSAR. W response to NUREG-0737, action item I.G.1 provided a proposal for low power testing of existing and future W PWRs in Attachment 4 to the letter from Westinghouse (E. P. Rahe) to the NRC (H. R. Denton) dated July 8, 1981. For the AP600, W proposes the following similar exception; noting that the appropriate tests are contained in the AP600 ITP:

1. During hot functional testing, prior to fuel load, with the reactor coolant pumps not running and no onsite power available, the heat removal capability of the PRHR heat exchanger with natural circulation flow is verified (Section 14.2.9.3, item e).
2. After fuel loading, but prior to criticality, with the reactor system at no-load operating temperature and pressure and all RCPs operating, the depressurization rate is determined by de-energizing the heaters and pressure is further reduced through use of sprays (Section 14.2.10.1.19).



3. After criticality is achieved and the plant is at ~ 3 percent power, the plant is placed in a natural circulation mode by tripping all reactor coolant pumps and observing the plant response (Section 14.2.10.3.6).
4. A loss-of-offsite power test is performed with the plant at minimum power level supplying normal house loads. The turbine is tripped and the plant is placed in a stable condition using batteries and the diesel generator (Section 14.2.10.4.26).
5. Data obtained from the natural circulation tests is provided for operator training on a plant simulator at the earliest opportunity.

The staff finds Westinghouse's response on the NUREG-0737, action item I.G.1 issue acceptable. However, Westinghouse has not provided adequate justification or information in the SSAR for the staff to conclude that the ITAAC process will (a) demonstrate that the physical layout and configuration of the proposed plant and key components (steam generators, pumps, piping, and reactor vessel) remain within the specified tolerances of the reference plant; and (b) validate the acceptance criteria, provided by Westinghouse, for the specific values or ranges of values for other system flow and performance measurements that are to be taken during the hot functional and power ascension testing to confirm that the overall flow characteristics of the proposed plant remain within the accepted bounds of the reference plant.

Additionally, Subsection 1.9.4.2.1, Item I.G.1, indicates that the passive residual heat removal (PRHR) system fulfills the natural circulation heat removal function for the AP600. Therefore, Subsection 14.2.10.3.6, "Natural Circulation," should be modified to conduct natural circulation testing with the PRHR. Otherwise, testing conducted under Subsection 14.2.9.1.3, "Passive Core Cooling System Testing," should be conducted in every plant provided that such testing is performed at conditions necessary and sufficient to demonstrate design and operating system parameters commensurate with those that would have been demonstrated by testing at conditions described under Subsection 14.2.10.3.6. If the latter testing option is selected, Westinghouse would also need to modify its response to NUREG-0737, action item I.G.1, accordingly. Therefore, OITS 1245/DSER Open Item 14.2.8-7 remained open.

In its May 9, 1997, response, Westinghouse proposed that a natural circulation heat removal test using the PRHR (Subsection 14.2.10.3.7) be included in the startup testing portion of the ITP to be performed in conjunction with the existing steam generator natural circulation test (Subsection 14.2.10.3.6). These tests would fulfill the requirements of NUREG-0737, action item I.G.1. SSAR Subsection 1.9.4.2.1, item I.G.1 and the exception to Regulatory Guide (RG) 1.68, Appendix A.4.t in SSAR Appendix 1A would be revised accordingly.

The staff confirmed that the new Section 14.2.10.3.7, "Passive Residual Heat Removal Heat Exchanger (First Plant Only)," provides for natural



circulation testing of the PRHR system during startup testing of the initial plant. In addition, all plants are subjected to natural circulation testing of the PRHR during hot functional testing as described in Section 14.2.9.1.3.(e), (f), and (g). The staff finds that these testing provisions, in conjunction with Revision 13 to SSAR Subsection 1.9.4.2.1, item I.G.1, and the exception to RG 1.63, Appendix A.4.t in SSAR Appendix 1A, adequately address natural circulation testing for the AP600 design. Therefore, OITS 1245/DSER Open Item 14.2.8-7 is closed.

- OITS 1247/DSER Open Item 14.2.8-9 is closed. Closure of this item was documented in the staff's March 20, 1997, letter to Westinghouse.
- OITS 1249/DSER Open Item 14.2.8-11: In the DSER, the staff found that Startup test Abstract 14.2.8.2.51 should be modified in Appendix 1A of the SSAR to include applicability of this testing to subsequent AP600 plants, or to provide appropriate justification for this exception to RG 1.68, Appendix A, Item 5.n.n.

In its August 13, 1996, response to the NRC, Westinghouse stated that "Subsection 14.2.10.4.21 specifies that the 100 percent load rejection test is to be performed only on the first AP600 plant. This testing provides measurements of the plant parameters including reactor power and primary and secondary pressures and temperatures that occur following this transient. Subsequent plants have similar equipment, control systems, and setpoints. The above first-plant-only test meets the following criteria used to establish which testing is to be performed only on the first AP600 plant: (a) the performance parameter(s) to be measured is not provided by previous certification, qualification, or prototype testing; and (2) construction and installation inspections and other preoperational tests, performed on every plant, demonstrate that the performance parameter(s) does not change from plant to plant."

In its November 8, 1996, response to Westinghouse the staff found that Westinghouse's justification for not demonstrating that the dynamic response of the plant is in accordance with design for the condition described in RG 1.68, Appendix A, Item 5.n.n., on all subsequent plants was unacceptable.

The staff added that RG 1.68, Appendix A, Item 5.n.n., provides for the demonstration that the dynamic response of the plant is in accordance with design for the case of a full load rejection transient with the plant's electrical distribution system aligned for normal full power operation, and in such a manner that the turbine-generator is subjected to the maximum credible overspeed condition. While the staff may agree that subsequent AP600 plants have similar equipment, control systems, and associated setpoints, this test is not conducted just to demonstrate that the performance parameters do not change from plant to plant. Rather, the purpose of this test is to demonstrate that the integrated dynamic response of the as-built plant, including all associated systems

and/or design features, conforms to the postulated plant response when subjected to this anticipated transient. Therefore, Subsection 14.2.10.4.21 needs to be modified to include applicability of this testing to subsequent AP600 plants. DSER Open Item 14.2.8-11 remained open.

In its December 6, 1996, response, Westinghouse stated that "This test will be performed on every plant."

The staff found Westinghouse's response acceptable and, therefore, OITS 1249/DSER Open Item 14.2.8-11 was considered confirmatory pending formal submittal of Revision 10 to SSAR Chapter 14.

In Revision 10 (and subsequently in Revision 11) of the SSAR, Subsection 14.2.10.4.21, "100 percent Load Rejection," which is to be conducted on each plant, is an external load rejection test which would not subject the turbine to the maximum credible overspeed condition. RG 1.68, Appendix A, Item 5.n.n, specifies that a full load rejection test be conducted on each plant and that the test should subject the turbine to the maximum credible overspeed condition. Therefore, Subsection 14.2.10.4.21, or other test abstract as appropriate, should be modified to test the full (external and internal) load rejection capability of each plant. OITS 1249/DSER Open Item 14.2.8-11 remained open.

In its May 9, 1997, response to the staff, Westinghouse proposed that the Plant Trip From 100 percent Power Test (Subsection 14.2.10.4.24) be modified to initiate the test by opening the main generator output breaker to achieve the maximum credible turbine overspeed condition.

The staff confirmed that Revision 13 to SSAR Section 14.2.10.4.24 has been modified to simulate a full load rejection event by opening the generator output breakers thereby subjecting the turbine-generator to the maximum overspeed condition. This test meets the recommendations of RG 1.68, Appendix A, Section 5.1.1 and 5.n.n, and is, therefore, acceptable. OITS 1249/DSER Open Item 14.2.8-11 is closed.

□ OITS 1251/DSER Open item 14.2.8-13 (RAI 260.26):

In the DSER, the staff found that Westinghouse should conduct a turbine trip test on subsequent AP600 plants. Westinghouse responded in their August 13, 1996, letter that Section 14.2.10.4.24, "Plant Trip from 100 percent Power," will be conducted on each plant. Staff review of this section determined that this test is initiated by a reactor trip, not a turbine trip. This test, or other test abstracts, should be modified to test the turbine trip response of all AP600 plants, or Appendix 1A in the SSAR should provide appropriate justification for this exception to RG 1.68, Appendix A, Item 5.1.1. Alternatively, consideration should be given to initiating the full load rejection testing described in Section 14.2.10.4.21 by a main generator breaker trip so that it could be conducted in lieu of the plant trip test

described in Section 14.2.10.4.24. This is acceptable in that RG 1.68, Appendix A, Item 5.1.1 specifies that a turbine trip test can be combined with testing in accordance with Item 5.n.n, if the test is initiated by a main generator breaker trip. OITS 1251/DSER Open Item 14.2.8-13 remained open.

In its May 9, 1997, response to the staff, Westinghouse indicated that its response to OITS 1249/DSER Open Item 14.2.8-11, above, addressed this issue. The staff finds Westinghouse's response acceptable. Therefore, OITS 1251/DSER Open Item 14.2.8-13 is closed.

- OITS 1252/DSER Open Item 14.2.8-14 is closed. In the staff's March 20, 1997, letter to Westinghouse, this item was documented as confirmatory pending closure of OITS 1236/DSER Open Item 14.2.2-2, above.
- OITS 1253/DSER Open Item 14.2.8-15 is closed. Closure of this item was documented in the staff's March 20, 1997, letter to Westinghouse.
- OITS 1254/DSER Open Item 14.2.8-16: Closure of this issue is contingent upon the satisfactory resolution of OITS 1255/DSER Open Item 14.2.8.3-1, below.
- OITS 1255/DSER Open Item 14.2.8.3-1: In the DSER, the staff found that the preoperational and startup test phase descriptions in Section 14.2.8 of the SSAR did not provide assurance that the operability of several of the systems and components listed in Appendix A of RG 1.68 (Revision 2, August 1978) will be demonstrated. The test abstracts of Section 14.2.8 of the SSAR should be expanded to address the following items identified in Appendix A to RG 1.68, or Appendix 1A of the SSAR should be revised to provide technical justification for any exceptions taken.

• Preoperational Testing

- 1.a.(2)(i)           pressurizer safety valves
- 1.b.(1)             control rod withdrawal inhibit and rod runback functions
- 1.c                 diverse actuation system, which protects the facility from anticipated transients without scram (ATWS)
- 1.e.(4)             steam generator pressure safety valves
- 1.e.(10)            feedwater heaters and drains
- 1.f.(2)             cooling towers and associated auxiliaries
- 1.j.(7)             leak detection systems used to detect failures in the emergency core cooling system (ECCS) and containment recirculation systems located outside containment (for example, potential leakage in the normal residual heat

- removal (RHR) system or the post-accident sampling systems that could be used to recirculate reactor coolant outside containment after an accident)
- 1.j.(8) automatic reactor power control system and primary T-average control system
  - 1.j.(13) excore neutron instrumentation
  - 1.j.(17) feedwater heater temperature, level, and bypass controls
  - 1.j.(20) instrumentation used to detect external and internal flooding conditions
  - 1.j.(22) instrumentation used to track the course of postulated accidents such as containment wide-range pressure indicators, reactor vessel water level monitors, containment sump level monitors, high radiation detectors, and humidity monitors
  - 1.j.(23) post-accident hydrogen monitors
  - 1.j.(24) annunciators for reactor control and engineered safety features
  - 1.k.(2) personnel monitors and radiation survey instruments (As the calibration program applied to these devices will be site-specific, it would be appropriate to identify this as a COL action item.)
  - 1.k.(3) laboratory equipment used to analyze or measure radiation levels and radioactivity concentrations
  - 1.l.(5) isolation features for condenser offgas systems
  - 1.m.(4) static load testing at 125 percent rated load of cranes, hoists, and associated lifting and rigging equipment
  - 1.n.(5) secondary sampling systems
  - 1.n.(9) drain systems and pumping systems serving essential areas
  - 1.n.(12) boron recovery system
  - 1.n.(13) communications systems relating to offsite emergency notification
  - 1.n.(14)(c) Class 1E electrical room heating, ventilating, and air conditioning

- 1.n.(14)(f) MCR (including proper operation of smoke and toxic chemical detection systems and ventilation shutdown devices, including leak tightness of ducts).
- 1.n.(15) shield cooling systems
- 1.o.(1) dynamic and static load tests of reactor components handling system cranes, hoists, and associated lifting and rigging equipment
- 1.o.(2) protective devices and interlocks of reactor components handling system equipment
- 1.o.(3) safety devices for reactor components handling systems equipment

- Initial Fuel Loading and Precritical Tests

- 2.f reactor core and other major components differential pressure and vibration testing after fuel loading

- Low Power Testing

- 4.i control rod block and inhibit functions

- Power Ascension Tests

- 5.m reactor core and major reactor coolant system components differential pressure
- 5.r process computer and control room computer
- 5.t pressurizer safety valves and secondary system safety valves
- 5.c.c gaseous and liquid radioactive waste processing, storage, and release systems (operating in accordance with design)
- 5.g.g design features to prevent or mitigate ATWS
- 5.k.k dynamic response of the plant for loss of feedwater heaters or bypassing feedwater heaters

These issues were previously identified by the staff in Q260.30 and were subsequently identified in the DSER as Open Item 14.2.8.3-1.

In its August 13, 1996, response to the staff, Westinghouse stated that "Subsection 14.2.9 has been revised to include test abstracts for appropriate AP600 systems and components as specified in RG 1.68, Revision 2, Appendix A."



In its November 8, 1996, response to Westinghouse, the staff found that Westinghouse had not satisfactorily revised test abstracts to demonstrate the requested items. A detailed review of the SSAR will be conducted to determine whether the test abstracts accurately reflect suitable test methods under the appropriate plant conditions. Therefore, DSER Open Item 14.2.8.3-1 remained open.

Nonetheless, the following items were provided to Westinghouse as initial comments derived from a limited review of these items.

- ° Appendix A to RG 1.68, Section (d) identifies steam line atmospheric dump valves and relief valves to be included in the preoperational testing. In Attachment 3 to the letter of July 16, 1996, Westinghouse listed these valves to be included in SSAR Chapter 14 Sections 14.2.9.2.1 and 14.2.9.1.2 respectively. However, the staff could not find the testing of these valves in the above two SSAR sections. Westinghouse is requested to add these valves according to Attachment 3.
- ° Appendix A to RG 1.68, Section (e) identifies steam generator pressure relief valves, turbine control and intercept valves, and main condenser hotwell level control system to be included in the preoperational testing. In Attachment 3 to the letter of July 16, 1996, Westinghouse listed these items to be included in SSAR Chapter 14 Sections 14.2.9.1.2, 14.2.9.2.1, or 14.2.9.4.1. However, the staff could not find the testing of SG pressure relief valves, turbine control and intercept valves in the above SSAR sections. Westinghouse is requested to add these items according to Attachment 3.
- ° Appendix A to RG 1.68, Section (f) identifies cooling towers and associated auxiliaries, and raw water and service water cooling towers to be included in the preoperational testing. In Attachment 3 to the letter of July 16, 1996, Westinghouse listed these items to be included in SSAR Chapter 14 Section 14.2.9.4.6. However, the staff could not find the testing of cooling towers and associated auxiliaries, and raw water and service water cooling towers in the above SSAR section. Westinghouse is requested to add these items according to Attachment 3.

In its December 6, 1996, response, Westinghouse stated the following:

"Section 14.2.9.1.2 Item a) commits to tests of safety-related valves in the SGs which includes the SG Power-Operated Relief (atmospheric dump) Valves. This section will be revised to delineate these valves specifically under item a).

Section 14.2.9.2.1 lists the other valves mentioned (with the appropriate AP600-specific name).

Test 14.2.9.4.6 does not specifically mention cooling towers for the following reasons:

- the circulating water system cooling tower is not within the scope of the AP600 design certification
- heat removal of an ultimate heat sink (such as a cooling tower) can not be tested during preops due to the absence of core power - commitments are made in 14.2.9.4.6 to test the ultimate heat sink (cooling tower or other) during hot functionals as appropriate

The service water cooling towers are tested as specified in 14.2.9.2.6."

The staff finds Revision 11 to the AP600 SSAR still does not address all issues identified under this open item. Specifically, the test abstracts of Sections 14.2.9 and 14.2.10 should be expanded to address the following items identified in Appendix A to RG 1.68, or Section 1.9 of the SSAR should be revised to provide technical justification for any exceptions taken.

1. Preoperational Testing

- 1.j.(7) Leak detection systems used to detect failures in normal RHR system, the post accident sampling system, or other systems that could be used to recirculate reactor coolant outside containment

2. Initial Fuel Loading and Precritical Tests

- 2.b Testing of control rod withdrawal and insert speeds
- 2.c Final functional testing of the reactor protection system
- 2.d Final test of the RCS to verify that system leak rates are acceptable
- 2.e Measurements of water quality.

4. Low Power Testing

- 4.e Determination of flux distribution to verify proper core loading and fuel enrichments
- 4.i Control rod block and inhibit functions
- 4.l Operability and response time tests of main steam isolation valves and their bypass valves at rated temperature and pressure conditions

- 4.r Operability of RCS purification and cleanup systems
- 4.u Operability of pressurizer pressure and level control systems
- 5. Power Ascension Tests
  - 5.l Design capability of residual or decay heat removal systems including turbine bypass valves, atmospheric dump valves, normal residual heat removal, and feedwater systems, including demonstration that excessive flow instabilities will not occur
  - 5.o Operability of RCS leak detection systems
  - 5.r Process computer and control room computer.
  - 5.s Operability of pressurizer pressure and level control systems
  - 5.u Operability and response time tests of main steam isolation valves and their bypass valves
  - 5.c.c Demonstrate that gaseous and liquid radioactive waste processing, storage, and release systems operate in accordance with design
  - 5.k.k Dynamic response of the plant for loss of feedwater heaters or bypassing feedwater heaters

Therefore, OITS 1255/DSER Open Item 14.2.8.3-1 remained open.

In its May 9, 1997, letter to the staff, Westinghouse responded with the following:

1. Preoperational Testing

- 1.j.(7) The AP600 does not have a dedicated system to detect leakage outside containment for the purpose of detecting leakage in the normal RHR system, post-accident sampling lines or other systems that penetrate containment and may circulate reactor coolant outside containment post-accident. This function is performed by the Radioactive Waste Drain System which is tested as discussed in Section 14.2.9.3.4.

2. Initial Fuel Loading and Precritical Tests

- 2.b The Performance Criterion section of SSAR Subsection 14.2.10.1.13 has been modified to include rod withdrawal and insert speeds.
- 2.c Final functional testing is accomplished by the precritical setpoint verification (Subsection 14.2.10.1.10) and the nuclear

instrumentation precritical testing (Subsection 14.2.10.1.9). These tests, in combination with the other precritical tests (such as rod control system test, rod drop time measurement, etc.) as well as the preoperational testing of the reactor protection system testing of system logic and operability of trip breakers and safety-related valves is sufficient to meet this requirement. This is consistent with the approach taken in precritical testing in current operating plants,

- 2.d RCS leak testing is performed during the preoperational testing as specified in Section 14.2.9.1.1. Once fuel load is accomplished, the plant must conform to the plant Technical Specifications (TSs) including the RCS leakage. Therefore, no additional test is required.
- 2.e Measurements of water quality at 0 percent power are performed and are discussed in Subsection 14.2.10.4.8. This section has been modified to provide the applicable SSAR references for water chemistry requirements.

#### 4. Low Power Testing

- 4.e This testing is performed during the ascension to power tests (as acknowledged in RG 1.68 Appendix A Section 4.e) as specified in 14.2.10.4.2. The objectives of this test has been modified to include determination of flux distribution to verify proper core loading and fuel enrichments.
- 4.i Test 14.2.10.1.11 has been modified to include testing of control rod block and inhibit functions.
- 4.l Operability and response time tests of main steam isolation valves and their bypass valves at rated temperature and pressure conditions is performed during the preoperational test of the steam generator system as discussed in Subsection 14.2.9.1.2. This section has been revised to explicitly include these valves.
- 4.r Operability of the RCS purification and cleanup systems is performed during the preoperational test of the chemical and volume control system discussed in SSAR Subsection 14.2.9.2.3 as revised.
- 4.u Operability of pressurizer pressure and level control systems is performed during the preoperational test of the reactor coolant system (Section 14.2.9.1.1) and during the testing of the pressurizer spray capability (14.2.10.1.19) included in the pre-critical testing phase of the ITP.

#### 5. Power Ascension Tests

- 5. Design capability of residual or decay heat removal systems including turbine bypass valves, atmospheric dump valves, normal residual heat removal, and feedwater systems, including demonstration that

excessive flow instabilities will not occur are all verified during the applicable portions of the various preoperational testing of these systems or subsystems and during the dynamic event testing specified in 14.2.9.1.7 and is also performed as required during the Dynamic Response test specified in 14.2.10.4.18 under the ascension to power test phase.

- 5.o RCS leak testing is performed during the preoperational testing as specified in Section 14.2.9.1.1. Once fuel load is accomplished, the plant must conform to the plant TSs including the RCS leakage. Therefore, no additional test is required.
- 5.r This testing is performed during the preoperational testing of the plant control system (14.2.9.2.12), the data display and processing system (14.2.9.2.13) with the exception of the nuclear instrumentation. The nuclear instrumentation is tested during the ascension to power testing discussed in Sections 14.2.10.4.2-4.
- 5.s Operability of pressurizer pressure and level control systems is performed during the preoperational test of the reactor coolant system (Section 14.2.9.1.1) and during the testing of the pressurizer spray capability (14.2.10.1.19) included in the pre-critical testing phase of the ITP. In addition, the performance of the pressurizer pressure and level control are verified during the Thermal Power Measurement and Statepoint Data Collection test (14.2.10.4.17). This test has been modified to include this verification.
- 5.u Operability and response time tests of main steam isolation valves and their bypass valves at rated temperature and pressure conditions is performed during the preoperational test of the steam generator system as discussed in Subsection 14.2.9.1.2. This section has been revised to explicitly include these valves.
- 5.c.c Demonstration that the gaseous and liquid radioactive waste processing, storage, and release systems operate in accordance with design is performed during the preoperational testing of these systems (14.2.9.3) and is supplemented by the Radiation and Effluent Monitoring System test (14.2.10.4.14) during the ascension to power phase of the ITP.
- 5.k.k A test of the dynamic response of the plant for the loss of a feedwater heater has been added to the ascension to power test as Section 14.2.10.4.27.

The staff has reviewed the Westinghouse response to each of the RG 1.68 items and finds the response acceptable with the following exceptions:



#### 4. Low Power Testing

- 4.1 While the proposed changes to Section 14.2.9.1.2(a) clarify the type of valves to be tested, they do not address the regulatory position in this paragraph of RG 1.68 that testing be performed at rated temperature and pressure. SSAR Sections 3.9.6 and 10.3 are referenced in the test abstract as sources of additional criteria, but review of these sections did not lead to the conclusion that testing would be performed at rated temperature and pressure. Westinghouse should specifically state the test conditions for these valves.

#### 5. Power Ascension Tests

- 5.1 Testing of the heat removal capability of the power operated relief valves (atmospheric dump valves) could not be located. The last sentence in Section 14.2.9.1.2 states that the heat transfer performance of the steam generator system is verified as part of reactor coolant system testing. While it is agreed that ADV testing could be performed as part of RCS testing, it is not evident from the existing test abstracts for the RCS, that they also involve verification of proper heat removal through the ADVs.
- 5.o Section 14.2.9.1.1 does not specify how leakage testing/verification is to be performed. TS compliance following fuel load relies on proper operation of plant leakage detection systems. GDC 30 requires that means for detection and identification of RCS leakage be provided. Leak detection is also necessary to support the application of Leak-Before-Break to high energy piping as described in Section 3.6 of the SSAR. Proper operation and calibration of the leakage detection systems, as described in SSAR Section 5.2.5, should be verified, and the ITP should be revised accordingly.
- 5.u See response to 4.1 above.
- 5.k.k The RG states that the dynamic response of the plant should be demonstrated for the most severe case of feedwater temperature reduction resulting from a credible loss of a feedwater heater(s) due to single failure or operator error. The controlled removal of feedwater heaters from service, as described in Section 14.2.10.4.27, does not meet the intent of the RG. Additionally, the RG states that this test is to be performed at 50 percent and 90 percent of rated power. The test prerequisites only require that power be "no less than 50 percent".

Therefore, OITS 1255/DSER Open Item 14.2.8.3-1 remains open.

- OITS 1256/DSER Open Item 14.2.8.4-1: In the DSER, the staff found that the preoperational and startup test phase descriptions in Section 14.2.8

of the SSAR did not provide assurance that the operability of several of the systems and components listed in the following RGs would be demonstrated. The test abstracts of Section 14.2.8 of the SSAR should be expanded to address the following items, or Appendix 1A of the SSAR should be revised to provide technical justification for any exceptions taken.

RG 1.68.2, "Initial Startup Test Program to Demonstrate Remote Shutdown Capability for Water-Cooled Nuclear Power Plants" - Preoperational test Abstract 14.2.8.1.94, "Remote Shutdown," does not provide sufficient detail to verify conformance with the following Regulatory Positions (RP) of RG 1.68.2:

- Hot Standby Demonstration (RP C.3), including the following:
  - With initial conditions of the reactor at a moderate power level (10 to 25 percent), demonstrate that plant systems are in the normal configuration with the turbine generator in operation and with the minimum shift crew
  - Using only credited remote shutdown equipment, demonstrate the capability to achieve hot standby status, and maintain stable hot standby conditions for at least 30 minutes.
- Cold Shutdown Demonstration (RP C.4), including the following:
  - with the plant at hot standby conditions;
  - with the procedurally designated crew positions;
  - using only credited remote shutdown equipment, demonstrate the capability to perform a partial cooldown by performing the following actions:
    - lower reactor coolant pressure and temperature sufficiently to permit operation of the residual heat removal (RHR) system
    - initiate and control operation of the RHR system
    - establish a heat transfer path to the ultimate heat sink
    - reduce reactor coolant temperature approximately 50 F using the RHR system

RG 1.68.3, "Preoperational Testing of Instrument and Control Air Systems" - Preoperational test Abstract 14.2.8.1.6, "Compressed and Instrument Air Systems," does not provide sufficient detail to verify conformance with the following RPs of RG 1.68.3:

- After coolers, oil separators, air receivers, and pressure-reducing stations (RP C.2)
- Flow, temperature, and pressure meet design specifications (RP C.4)
- Total air demand with leakage meets design (RP C.5)
- Single failure criterion (RP C.7)
- Sudden and gradual loss of system pressure and appropriate response of air power equipment (RP C.8)
- Functional test for increase in the air supply system pressure does not cause loss of operability (RP C.11)

RG 1.140 - Preoperational test Abstracts 14.2.8.1.28, "Containment Air Filtration System," 14.2.8.1.29, "Radiologically Controlled Area Ventilation Test," and 14.2.8.1.88, "High-Efficiency Particulate Air Filters and Charcoal Absorbers" do not provide sufficient detail to verify conformance with the following RP of RG 1.140.

- heaters (RP C.3.a)
- prefilters (RP C.3.m)
- HEPA filters DOP tests (RPs C.3.b and C.5.c)
- ductwork (RP C.3.f)
- fans and motors mounting and ductwork (RP C.3.i)
- dampers (RP C.3.l)
- adsorber sections/cells and activated charcoal (RPs C.3.h and C.5.d)

These issues were previously identified by the staff in Q260.31. This was identified in the DSER as Open Item 14.2.8.4-1.

In its August 13, 1996, response to the NRC, Westinghouse stated the following:

"Subsection 14.2.9.1.12 has been revised to include testing to verify the ability to initiate actuation signals to the systems/components required for reactor shutdown from the remote shutdown workstation. Note that the AP600 remote shutdown workstation provides the operator with

the same capability to maintain the plant at hot shutdown conditions, or to cool the plant down; as is provided from the MCR. Therefore, the operator does not need to perform manual actions or operate equipment from local control panels. In addition, test abstracts for the instrument and compressed air system and appropriate HVAC systems have been revised.

In its November 8, 1996, response to Westinghouse, the staff concluded that Westinghouse had not satisfactorily revised test abstracts to demonstrate the requested items. In general, the revised test abstracts provide less detail than did their predecessors. A detailed review of the SSAR will be conducted to determine whether the test abstracts accurately reflect appropriate test conditions. Therefore, DSER Open Item 14.2.8.4-1 remained open.

In December 6, 1996, response, Westinghouse stated the following:

"Westinghouse would appreciate specific comments from the staff on the appropriate test abstracts so that we can address the staff's concerns in these areas more readily.

For the instrument and control air systems, and the containment air filtration system, it should be noted that these are non-safety systems in the AP600 and therefore may not require as explicit details for testing these systems."

During its review of Revision 11 of the SSAR, the staff concluded that Westinghouse has satisfactorily addressed the staff's concerns related to RG 1.140. However, the following issues remain with respect to RG 1.68.2 and RG 1.68.3:

#### RG 1.68.2

Section 1.9, Appendix 1A, states that exception has been taken regarding testing of the AP600 remote shutdown workstation in accordance with RG 1.68.2. The basis for this exception is the similarity of the remote shutdown station (RSS) to the MCR workstations, the testing of plant control capability from the MCR, and the testing of the RSS controls and indications during pre-operational testing.

The RSS testing in the ITP is described in Sections 14.2.9.1.12 and 14.2.9.2.12. Section 14.2.9.1.12, "Protection and Safety Monitoring System Testing," tests, in part, manual reactor trip capability from the RSS, and also tests the processing of manual actuation commands from the RSS to the protection logic cabinets through simulated command inputs to the logic cabinets and simulated logic cabinet outputs on component status to the RSS. Section 14.2.9.2.12, "Plant Control System Testing," provides testing of RSS control functions based on simulated inputs at the RSS and verification of proper output through contact operation, component actuation, or electrical test.



While similarity of the RSS workstations to those in the MCR, and successful testing of the MCR workstations and individual RSS process signals can provide a certain level of confidence with regard to proper RSS operation, they do not suffice as a replacement for integrated control system testing of the RSS. In addition, although the control room and RSS workstations may be similar, the working environment is different to the operator from that of the control room which is the normal workspace. The operators should demonstrate the ability to perform plant control in an abnormal work environment with the minimum set of controls and indications available under postulated control room evacuation scenarios. The Section 14 test abstracts should therefore be modified to demonstrate the remote shutdown capability of the plant in accordance with RG 1.68.2.

### RG 1.68.3

During the March 21, 1995 meeting, Westinghouse committed to resolving RAI 410.161 (Item No. 244) by including pre-operational testing as described in RG 1.68.3, "Preoperational Testing of Instrument and Control Air Systems" in Section 14.2.9.4.10, "Compressed and Instrument Air System Testing." Specifically, the following information still needs to be added to the test abstract.

- a. All safety-related pneumatically operated valves should be verified to fail in the position specified in SSAR Table 9.3.1-1 upon a complete and sudden loss of instrument air pressure and a gradual loss of instrument air pressure.
- b. The instrument air system should be functionally tested to ensure credible failures resulting in an increase in instrument air system pressure will not cause loss of operability.
- c. The instrument air system air quality should be tested to meet ANSI/ISA S7.3, "Quality Standard for Instrument Air."
- d. While at instrument air system normal steady state conditions, if practical, simultaneously operate those plant components requiring large quantities of instrument air for operation, to verify pressure transients in the distribution system do not exceed acceptable values.
- e. Verify that the total air demand at normal steady state conditions, including leakage from the systems, is in accordance with design.
- f. Additionally, the test abstract should include the following statements:
  - "Demonstrate the operability of the air compressor dryers and filters, intercoolers, aftercoolers, moisture separators, and air receivers."

- "Verify appropriate differential pressures (e.g., delta P across prefilters and afterfilters)."
- "Verify relief valve settings."

Therefore, OITS 1256/DSER Open Item 14.2.8.4-1 remained open.

In its May 9, 1997, response to the staff, Westinghouse stated the following:

- 1.68.2 A test of the remote shutdown workstation has been added as Section 14.2.10.4.28.
- 1.68.3 Westinghouse has modified the Compressed and Instrument Air System preoperational test (Subsection 14.2.9.4.10) to provide sufficient detail to show conformance to the applicable portions of RG 1.68.3.

The staff finds Revision 13 to SSAR Section 14.2.10.4.28, "Remote Shutdown Workstation," acceptable. However, the exception to RG 1.68.2 in Appendix 1A of the SSAR should be deleted based on the new test for the remote shutdown station as described in Section 14.2.10.4.28 of the ITP.

Revision 13 to SSAR Section 14.2.9.4.10 adequately incorporated the staff's comments on the test abstract with the exception to a specific reference to ANSI/ISA S7.3, "Quality Standard for Instrument Air." Nevertheless, the test abstract also states that testing will verify system functions as described in SSAR Section 9.3.1. Section 9.3.1.4, "Tests and Inspections," cites the standards for air quality, including ANSI/ISA S7.3. Therefore, Section 14.2.9.4.10 is acceptable. OITS 1256/DSER Open Item 14.2.8.4-1 remains open pending revision to the exemption in Appendix 1A of the SSAR for RG 1.68.2.

- OITS 1257/DSER Open Item 14.2.9-1: In the DSER, the staff recommended that Section 14.2.9 of the SSAR be retitled as "COL License Information - Initial Test Program." This title would more accurately reflect the purpose of this section within the SSAR (i.e., to identify the information to be supplied to the NRC by COL applicants referencing the AP600 design). In addition, the content of Section 14.2.9 of the SSAR should be revised to include "site-specific aspects of the plant," such as the following systems that may require testing "to satisfy certain AP600 interface requirements":

- electrical switchyard equipment
- site security plan equipment
- personnel monitors and radiation survey instruments
- automatic dispatcher control system (if applicable)

This item corresponds to Q260.32 and was identified in the DSER as Open Item 14.2.9-1.

In its August 13, 1996, response to the NRC, Westinghouse stated that "Section 14.3 provides reference to COL information items to verify site specific aspects of the plant that may require testing are within the certification envelope."

In its November 8, 1996, response to Westinghouse the staff clarified that in its July 22, 1994, letter to the NRC, and in response to Q260.32, Westinghouse had agreed to the staff's proposed revisions and recommendations. However, Revision 9 to the SSAR has relocated such information to Section 14.3, "Certified Design Material." In its August 13, 1994, response to this open item, Westinghouse stated that Section 14.3 "provides reference to COL information items to verify site specific aspects of the plant that may require testing are within the [design] certification envelope."

Based on the above, the staff requested that Westinghouse identify which subsection of Section 14.3, "Certified Design Material," designates "site-specific aspects of the plant" that may require testing by the COL applicant to satisfy certain AP600 interface requirements, such as those identified in Q260.32. DSER Open Item 14.2.9-1 remained open.

In its December 6, 1996, response, Westinghouse stated the following:

"Interface requirements as defined by 10 CFR Part 52.47 (a)(1)(vii) are discussed in Section 14.3, fourth bullet. It is not necessary to provide a list of possible systems that may or may not require testing, as this determination will be made by the NRC at the time of the COL application."

The staff disagrees with Westinghouse's interpretation of §52.47(a)(1)(vii). Westinghouse needs to specifically identify the structures and systems that are wholly or partially outside the design scope and specify the interface requirements for those systems, including testing to be performed by the COL applicant. Westinghouse should address this issue in conjunction with Q640.52. OITS 1257/DSER Open Item 14.2.9-1 remained open.

In its May 9, 1997, response to the staff, Westinghouse stated that Table 1.8-1 provides a summary of the AP600 plant interfaces with the remainder of the plant (outside of design certification). Westinghouse proposed that Section 14.3.4 be revised to state that verified testing of interfacing systems is the responsibility of the combined license applicant. In addition, Subsection 14.4.5, Interface Documents, would be added to include a list of these plant interfaces that may require testing to be performed by the combined license applicant. The lists would consist of the following:

- storm drains (item 2.10)
- site seismic sensors (item 3.3)
- offsite (switchyard) ac power systems (item 8.2)
- circulating water heat sink (item 9.3)
- raw and sanitary water systems (item 9.5)

equipment associated with fire protection program (item 9.7)  
personnel monitors and portable radiation survey instruments (item 12.1)

The staff finds that Revision 13 to Subsections 14.3.4 and 14.4.5 to the SSAR adequately designates site-specific aspects of the plant which require testing by the COL applicant to satisfy AP600 interface requirements. However, OITS 1257/DSER Open Item 14.2.9-1 remains open pending satisfactory resolution of Q640.52.

- OITS 1258/DSER Open Item 14.2.9-2 is closed. Closure of this item was documented in the staff's March 20, 1997, letter to Westinghouse.

- OITS 1791/DSER Confirmatory Item 3.9.2.1-3 (RAI 210.55):

In the DSER, the staff found that Westinghouse should revise Section 14.2.8.2.18 (start-up thermal expansion testing) to reflect the response to RAI 210.55. Staff review determined that Revision 9 for SSAR Chapter 14 replaced Section 14.2.8.2.18 with Section 14.2.10.4.25, "Thermal Expansion," and that the response to RAI 210.55, which was the basis for DSER Confirmatory item 3.9.2.1-3, does not appear in this new section. As committed to in the response to RAI 210.55, the test specifications for thermal expansion testing during preoperational and start-up testing are in accordance with ASME OM Standard, Part 7. This commitment is in Section 14.2.9.1.7 for preoperational testing. This same commitment should be added to Section 14.2.10.4.25 for startup testing. Therefore, OITS 1791/DSER Confirmatory Item 3.9.2.1-3 remained open.

In its May 9, 1997, response to the staff, Westinghouse proposed that a reference to ASME OM Standard Part 7 be added to Section 14.2.10.4.25 for startup testing.

Revision 13 to Section 14.2.10.4.25 references ASME OM Standard Part 7 as requested, and therefore, OITS 1791/DSER Confirmatory Item 3.9.2.1-3 is closed.

- OITS 1792/DSER Confirmatory Item 3.9.2.1-4 (RAI 210.57):

In the DSER, the staff found that Westinghouse should revise Section 14 test abstracts to reflect the response to RAI 210.57. Westinghouse responded in their August 13, 1996, letter that Section 14.2.9.1.7, "Expansion, Vibration and Dynamic Effects Testing," was revised to include reference to Section 3.9.2. Staff review determined that a reference to SSAR Section 3.9 is in the first paragraph of Section 14.2.9.1.7, however, as committed to in the response to RAI 210.57, a specific reference to Section 3.9.2.1.1 for the acceptance standard for alternating stress intensity due to vibration should be added to Sections 14.2.9.1.7(b) and 14.2.10.4.18. Therefore, OITS 1792/DSER Confirmatory Item 3.9.2.1-4 remained open.



In its May 9, 1997, response to the staff, Westinghouse stated that a specific reference to Section 3.9.2.1.1 for the acceptance standard for alternating stress intensity due to vibration was previously included in Section 14.2.9.1.7(b) would be added to Section 14.2.10.4.18.

Revision 13 to Section 14.2.10.4.18 references SSAR Section 3.9.2.1.1 as requested. Therefore, OITS 1792/DSER Confirmatory Item 3.9.2.1-4 is closed.

❑ OITS 1793/DSER Confirmatory Item 3.9.2.3-1 (RAI 210.58):

In the DSER, the staff found that Westinghouse should revise Section 14.2.8.1.77 (reactor internals and reactor coolant system vibration test) to reflect the response to RAI 210.58. Staff review determined that Section 14.2.8.1.77 was replaced by Section 14.2.9.1.9, "Reactor Vessel Internals Vibration Testing," in Revision 9 of Chapter 14. This new section only addresses the prototype plant (first plant only) tests to comply with that portion of RG 1.20. There should be another section in Chapter 14 to provide the same commitment as that in Section 3.9.2.4 for non-prototype plants. OITS 1793/DSER Confirmatory Item 3.9.2.3-1 remained open.

In its May 9, 1997, response to the staff, Westinghouse stated that Revision 10 to the SSAR satisfactorily addressed this issue. The staff finds that Revision 13 to Section 14.2.9.1.9 is consistent with, and references, SSAR Section 3.9.2.4. Therefore, OITS 1793/DSER Confirmatory Item 3.9.2.3-1 is closed.

❑ OITS 1828/DSER Confirmatory Item 14.2.7-1 is closed. Closure of this item was documented in the staff's March 20, 1997, letter to Westinghouse.

❑ OITS 1963/DSER COL Open Item 14.2.2-1 is closed. In the staff's March 20, 1997, letter to Westinghouse, this item was documented as confirmatory pending closure of OITS 1236/DSER Open Item 14.2.2-2, above.

❑ OITS 1964/DSER COL Open Item 14.2.2-2 is closed. In the staff's March 20, 1997, letter to Westinghouse, this item was documented as confirmatory pending closure of OITS 1236/DSER Open Item 14.2.2-2, above.

❑ OITS 1965/DSER COL Open Item 14.2.2-3 is closed. In the staff's March 20, 1997, letter to Westinghouse, this item was documented as confirmatory pending closure of OITS 1236/DSER Open Item 14.2.2-2, above.

❑ OITS 1966/DSER COL Open Item 14.2.2-4 is closed. Closure of this item was documented in the staff's March 20, 1997, letter to Westinghouse.

- OITS 1967/DSER COL Open Item 14.2.2.2-1 is closed. Closure of this item was documented in the staff's March 20, 1997, letter to Westinghouse.
- OITS 1968/DSER COL Open Item 14.2.8-1 is closed. Closure of this item was documented in the staff's March 20, 1997, letter to Westinghouse.
- OITS 2543/RAI 260.35: In RAI 260.35, the staff requested that reactor coolant system testing be modified to clearly indicate that if there is any evidence of leakage within the hydrostatic test boundaries, that the leak is to be repaired and retested prior to final inspection. Westinghouse responded in their August 13, 1996, letter that Section 14.2.9.1.1, "Reactor Coolant System Testing," has been revised to indicate that if there is any evidence of leakage, that the leak is to be repaired and retested prior to final inspection. Staff review of Section 14.2.9.1.1, "Reactor Coolant System Testing," indicates that it has not been modified as stated. The wording of this section still allows a leak to be isolated, repaired and retested at a later date. This section should be modified to remove the allowance for retesting at a later date. OITS 2543/RAI 260.35 remained open.

In its May 9, 1997, response to the staff, Westinghouse stated that leakage through valve seats, valve packing, flanges, and threaded or mechanical fittings is acceptable during the hydrostatic test as long as the hydrostatic test pump can maintain test pressure. Leakage through the above items may as necessary and/or practical be isolated, repaired and retested at a later date. However, all identified pressure boundary leaks (i.e. piping, welds, vessel walls, valve bodies, etc.) will be repaired and the hydrostatic test will be repeated. Section 14.2.9.1.1 would be revised to clarify this position.

The staff finds that the Westinghouse's response is consistent with the ASME code requirements for hydrostatic testing and is, therefore, acceptable. OITS 2543/RAI 260.35 is closed.

- OITS 2547/Q260.39: ITP Test Abstract 14.2.8.1.30, Feedwater Control System: The Test Method subsection should be revised to incorporate verification that automatically initiated valve open/closure cycling and timing meets the system design basis requirements.

In its August 13, 1996, response to the NRC, Westinghouse stated that "The test abstract for the steam generator system in Subsection 14.2.9.1.2, specifies that the proper operation of the main and startup feedwater valves is verified, including automatic open/close valve operation and timing. Additional testing of the main feedwater valves is specified with the reactor at power during the startup testing described in Subsection 14.2.10.1.22."

In its November 8, 1996, response to Westinghouse the staff concluded that Subsection 14.2.9.1.2 does not specify that the proper operation of main and startup feedwater valves is verified as noted. Therefore, OITS 2547/Q260.39 remained open.

In its December 6, 1996, response to the NRC, Westinghouse stated the following:

"Section 14.2.9.1.2 bullet (a) verifies proper operation of safety-related valve functions and includes the main feedwater SG isolation valves.

Section 14.2.9.2.2 bullet(a) tests the defense-in-depth valve functions associated with the FWS to verify their proper operation. This section is revised to include verification of the proper functioning of the main feedwater pump and control valves."

While the staff agreed with Westinghouse with regards to the content of Subsections 14.2.9.1.2 and 14.2.9.2.2, during its review of Revision 11 of the SSAR, Chapter 14, the staff found that Subsection 14.2.10.1.20, "Feedwater Valve Stroke Test," should be modified to provide an acceptable reference to system design basis requirements for allowable closure and cycling times. Therefore, OITS 2547/Q260.39 remained open.

In its May 9, 1997, response to the staff, Westinghouse stated that the performance criteria for this test would be revised to reference the appropriate SSAR Section (7.7.1.8) and appropriate design specifications.

The staff finds that Revision 13 to SSAR Section 7.7.1.8 does not specify criteria directly related to the issue of allowable closure and cycling times. Therefore, OITS 2547/Q260.39 remains open.

- OITS 2552/RAI 260.44: In RAI 260.44, the staff requested that various reactor coolant system flow measurements be verified, including baseline RCS pressure drops. Westinghouse responded in their August 13, 1996, letter that Section 14.2.9.1.1, "Reactor Coolant System Testing," has been revised to include appropriate flow measurement testing. Staff review of this section determined that baseline RCS pressure drop testing is not specified. Section 14.2.9.1.1, "Reactor Coolant System Testing," should be revised to include the establishment of, and appropriate acceptance criteria for, baseline RCS pressure drops. OITS 2552/RAI 260.44 remained open.

In its May 9, 1997, response to the staff, Westinghouse stated that it would not require baseline RCS pressure drops to be recorded for individual RCS components. Overall system flow rate information is obtained during preoperational testing and startup testing of the RCS.

The staff finds that if determination of RCS pressure drops is not necessary for the AP600, then exceptions to the provisions in RG 1.68, Appendix A, paragraphs 2.f and 5.m should be included in SSAR Section 1.9. Therefore, OITS 2552/RAI 260.44 remains open.

- OITS 2558/RAI 260.50: In RAI 260.50, the staff requested that, among other items, the initial fuel loading test sequence should outline all systems required for the initial fuel loading. Westinghouse responded in their August 13, 1996, letter that Sections 14.2.10.1.1 and 14.2.10.1.5 had been modified accordingly. Staff review of these sections determined that the revision did not completely address the noted issues. The prerequisites of either Section 14.2.10.1.1, "Fuel Loading Prerequisites and Periodic Checks," or Section 14.2.10.1.5, "Initial Fuel Loading," should be modified to outline all systems required for initial fuel loading, and should additionally address criteria or prerequisites for minimum count rate, instrumentation signal to noise ratios, criticality predictions, and any special procedural actions. Rod withdrawal sequences should also be specified to be the same as for a normal startup. (RG 1.68, Appendix A, Section 3). OITS 2558/RAI 260.50 remained open.

In its May 9, 1997, response to the staff, Westinghouse stated that the minimum conditions for initial fuel loading and initial criticality are provided in Section 14.2.7. Section 14.2.7 would be revised to state that the systems and conditions necessary to bring the plant into compliance with the TSs must be in place prior to initial fuel load.

Minimum count rate, instrumentation signal to noise ratios, criticality predictions, and rod withdrawal sequences would be addressed in the Initial Criticality and Nuclear Instrumentation During Criticality tests (Sections 14.2.10.2.2 and 14.2.10.2.3 respectively).

The staff finds that the minimum count rate and signal to noise ratios as discussed in RG 1.68, Appendix A, Section 3, are not specified in the cited tests. Minimum count rate and signal to noise ratio criteria should be included in the prerequisites of 14.2.10.2.2, 14.2.10.2.3 or other tests as appropriate. Therefore, OITS 2558/RAI 260.50 remains open.

- OITS 2559/RAI 260.51: In RAI 260.51, the staff requested that certain test abstracts be revised to provide specific acceptance criteria or design basis functional requirements traceable to the appropriate SSAR sections. Westinghouse responded in their August 13, 1996, letter that the noted test abstracts have been revised. Staff review of the revised Chapter 14 submittal determined that a number of additional sections require more detailed acceptance criteria. The following sections should be revised to provide or reference specific acceptance criteria or design basis functional requirements traceable to specific subsections or numbered paragraphs of the SSAR, the plant TSs, or other appropriate references that contain the detailed structure, system, or component design/performance criteria that is being verified by the testing:

14.2.10.1.7	14.2.10.1.10	14.2.10.1.15
14.2.10.1.8	14.2.10.1.11	14.2.10.1.16
14.2.10.1.9	14.2.10.1.12	



14.2.10.1.19  
 14.2.10.1.20  
 14.2.10.2.3  
 14.2.10.2.4  
 14.2.10.3.2  
 14.2.10.3.3  
 14.2.10.3.5  
 14.2.10.3.6

14.2.10.4.3  
 14.2.10.4.5  
 14.2.10.4.7  
 14.2.10.4.10  
 14.2.10.4.13  
 14.2.10.4.15  
 14.2.10.4.20

Therefore, OITS 2559/RAI 260.51 remained open.

In its May 9, 1997, response to the staff, Westinghouse provided the following table to outline the additional performance criteria references that would be added to the noted sections of the SSAR.

SSAR Section	Additional Reference Provided
14.2.10.1.7	4.4.6; 7.2
14.2.10.1.8	4.4.6; 7.2; 7.3
14.2.10.1.9	4.4.6
14.2.10.1.10	Technical Specifications
14.2.10.1.11	7.7.1.2
14.2.10.1.12	7.7.1.3
14.2.10.1.15	7.7.1.10
14.2.10.1.16	7.7.1.1
14.2.10.1.19	7.7.1.6
14.2.10.1.20	7.7.1.8
14.2.10.2.3	4.4.6
14.2.10.2.4	4.3.2.6
14.2.10.3.2	4.3.2.2.8
14.2.10.3.3	Technical Specifications
14.2.10.3.5	4.3.2.5
14.2.10.3.6	Design Specifications
14.2.10.4.3	4.4.6
14.2.10.4.5	7.7.1.1
14.2.10.4.7	7.7.1.1

SSAR Section	Additional Reference Provided
14.2.10.4.10	4.3.2.4.16
14.2.10.4.13	7.7.1.8
14.2.10.4.15	9.4.6; 9.4.1
14.2.10.4.20	7.7.1.1

The staff finds the added references acceptable with the following exceptions:

SSAR Section	Additional Reference Provided	Comment
14.2.10.1.7	4.4.6; 7.2	It is not clear what design requirements in Section 7.2 are applicable to the incore instrumentation, and specifically the thermal couples, as stated in the revised test.
14.2.10.1.8	4.4.6; 7.2; 7.3	SSAR Section 4.4.6 does not describe the calibration procedure as indicated in the revised test abstract.
14.2.10.1.16	7.7.1.1	The referenced section does not provide nor define design requirements or limits for the RCS temperature variables listed in the test abstract performance criterion.
14.2.10.1.20	7.7.1.8	The specified criteria in the revised test were not found in Section 7.7.1.8.
14.2.10.2.4	4.3.2.6	SSAR Section 4.3.2.6 discusses criticality control during refueling (which merely references other SSAR sections), and for fuel handling outside the reactor, and does not appear to be the appropriate reference.
14.2.10.3.2	4.3.2.2.8	SSAR Section 4.3.2.2.8 references Chapter 14 for the acceptance criteria.
14.2.10.4.5	7.7.1.1	SSAR Section 7.7.1.1 does not describe the criteria as stated in the revised test.

SSAR Section	Additional Reference Provided	Comment
14.2.10.4.10	4.3.2.4.16	SSAR Section 4.3.2.4.16 does not appear to be the appropriate reference for design requirements related to limits on RCS temperatures as described in the revised abstract.

Based on the remaining issues that require resolution as noted above, OITS 2559/RAI 260.51 remains open.

- OITS 2563/RAI 260.55 In RAI 260.55, the staff stated that the post-fuel loading precritical test sequence was inadequate in that revision was required of the prerequisites, test method, and acceptance criteria subsections. Westinghouse responded in their August 13, 1996, letter that Section 14.2.10.1.6, "Post-Fuel Loading Precritical Test Sequence," has been revised to specify plant system conditions and acceptance criteria as contained in subsequent precritical testing. Staff review of this section determined that it does not provide any additional information than is already provided in other existing test abstracts. If the intent of this section is to provide a test sequence or to outline all systems required for initial criticality, it should be modified accordingly. OITS 2563/RAI 260.55 remained open.

In its May 9, 1997, response to the staff, Westinghouse acknowledged that this test abstract does not provide additional testing information. The purpose of this test abstract is to provide a commitment that a detailed Post-Fuel Loading Precritical Test Sequence shall be included in the ITP such that the initial approach to criticality is performed in a deliberate and orderly manner. The level of detail contained in this test abstract is consistent with previous ITPs included in FSARs for Westinghouse PWRs.

The staff does not object to the purpose of this test abstract as stated above and, therefore, OITS 2563/RAI 260.55 is closed.

- OITS 2567/RAI 260.59: In RAI 260.59, the staff requested that the load swing test be revised to address a number of specific concerns including providing acceptable ranges of key plant parameters. Westinghouse responded in their August 13, 1996, letter that Section 14.2.10.4.20, "Load Swing Test," acceptance criteria has been expanded to include a review of plant response and adjustment of control systems, if necessary. Staff review of this section determined that it has not been expanded from the earlier submittal. The performance criterion subsection should be modified to specify or reference the acceptable ranges of the evaluated parameters. OITS 2567/RAI 260.59 remained open.

In its May 9, 1997, response to the staff, Westinghouse proposed that the performance criteria for this test be modified to reference 7.7.1.1.

The staff finds that the reference to SSAR Section 7.7.1.1 is not sufficient to provide criteria for the measured parameters specified in the test abstract. Additional criteria or references specific to the measured parameters should be provided. Therefore, OITS 2567/RAI 260.59 remains open.

- OITS 2568/Q260.60 is closed. Closure of this item was documented in the staff's March 20, 1997, letter to Westinghouse.
- OITS 2570/Q260.62 is closed. Closure of this item was documented in the staff's March 20, 1997, letter to Westinghouse.
- OITS 2571/RAI 260.63: In RAI 260.63, the staff requested that preoperational testing should be provided for the 480V non-Class 1E transportable ac generator and its distribution panel. Westinghouse responded in their August 13, 1996, letter that Section 14.2.9.1.16, "Long-Term Safety-Related System Support Testing," has been revised to include verification of the proper operation of the generator. Staff review determined that this section only tests the ability to power post-accident monitoring instrumentation from the portable generator. Table 8.3.1-4 of the SSAR lists several other design loads, including certain fixed and portable HVAC systems, and Control Room/Remote Shutdown Station lighting, that are additionally potentially powered from the portable generator. The portable units should be tested to ensure that they can supply design load to these various systems. OITS 2571/RAI 260.63 remains open.

In its May 9, 1997, response to the staff, Westinghouse proposed that Section 14.2.9.1.16, "Long-Term Safety-Related System Support Testing" be revised to incorporate testing of the design loads of the various systems requiring electrical power including post-accident instrumentation, control room lighting and ventilation, I&C room ventilation, passive containment cooling system pumps, ancillary generator room lights, and ancillary generator fuel heaters. In addition, this section would be revised to reflect recent design changes made to the AP600 in response to SECY-96-128 including:

- o Deletion of the testing of MCR compressed air supply which is no longer used for long-term air supply.
- o The use of ancillary fans to provide ventilation cooling to the MCR and the post-accident monitoring instrumentation equipment rooms as described in SSAR Section 9.4.1.
- o The addition of the passive containment cooling system water storage tank as a source of makeup water to the spent fuel pool.



The staff finds that Revision 13 to SSAR Section 14.2.9.1.1 is consistent with Table 8.3.1-4 of the SSAR. However, OITS 2571/RAI 260.63 remains open pending resolution of issues identified in SECY-96-128.

- OITS 2641/Q260.67: Chapter 14 - ITP. 14.2.8.1.18, In-Plant Communication System: The Test Methods and Performance Criterion subsections of this abstract need to be revised to demonstrate acceptable performance of all subsystems encompassed by the In-Plant Communication System as described in SSAR Section 9.5.2.

In its August 13, 1996, response to the NRC, Westinghouse stated that "The test abstract for the plant communication system in Subsection 14.2.9.4.13 has been revised to include verification of the proper performance of the system subsystems."

In its November 8, 1996, response to Westinghouse, the staff found that SSAR Section 9.5.2 states that the In-plant Communication system includes the following subsystems:

- Wireless telephone system
- Telephone/page system
- Private automatic branch exchange (PABX) system
- Sound power phone system
- Emergency response facility communication system
- Security communication system

The communication system allows each guard, watchman or armed response individual on duty, to maintain continuous communication with an individual at each manned alarm station (access to vital areas) and with off-site agencies as required by 10 CFR 73, Section 55 (e) Detection Aids, and (f) Communication Requirements. Communication equipment used with respiratory protection devices will be designed and selected in accordance with EPRI guidance document NP-6559, "Voice Communication Systems Compatible with Respiratory Protection."

The "General Test Methods and Acceptance Criteria" should include a procedure to verify the above commitments. Therefore, OITS 2641/Q260.67 remained open.

In its December 6, 1996, response to the NRC, Westinghouse stated that "These subsystems will be added to Subsection 14.2.9.4.13."

The staff has reviewed Revision 11 to the SSAR, Chapter 14, and found that Subsection 14.2.9.4.13 now includes the subsystems identified in SSAR Subsection 9.5.2. However, Westinghouse did not include a commitment to EPRI guidance document NP-6559 as requested by the staff. Therefore, this portion of OITS 2641/Q260.67 remained open.

In its May 9, 1997, response to the staff, Westinghouse stated that Item (d) in Section 14.2.9.4.13 specifies that the plant communication systems testing be performed to verify its operation under abnormal conditions as necessary for execution of the plant emergency plan. This

test is consistent with the intent of the EPRI guidance document. There is no regulatory basis for Westinghouse to commit to the use of this EPRI guidance document, however, this document (or a later version) will be available to the COL applicant to develop the detailed test procedure. It is additionally noted that the use of respiratory devices in instances where significant communication is required has been dramatically reduced as part of the Total Effective Dose Equivalent dose methodology.

The staff finds the Westinghouse response inconsistent with SSAR Section 9.5.2, "Communication System." The specific use of EPRI NP-6559 for the design and selection of respiratory protection devices is a commitment in this section of the SSAR. Nevertheless, verification of such a commitment is outside the scope of the ITP. Therefore, OITS 2641/Q260.67 is closed.

- OITS 2642/Q260.68: Chapter 14 - ITP. 14.2.8.1.51, Operations and Control Center System: This test abstract does not reflect the design and configuration of the AP600 Operations and Control Center System. Specifically, the primary plant control system operator interface is a set of "soft" control units that replace conventional switch/light or potentiometer/meter assemblies used for operator interface with control systems. The function-based test analysis serves as the basis for determining the alarms, displays, controls, and procedures in the main control area.

The Test Methods and Performance Criterion subsections of this abstract need to be revised to demonstrate acceptable performance of, and to encompass, these unique AP600 design features.

In its August 13, 1996, response to the NRC, Westinghouse stated that "The test abstract for the plant control system in Subsection 14.2.9.2.12 has been revised to reflect the use of "soft" controls and function-based analysis for alarms, displays, controls, and procedures used in the AP600."

In its November 8, 1996, response to Westinghouse, the staff found that the general test methods and acceptance criteria should include the use of "soft" controls and function-based analysis for alarms, displays, controls, and procedures used in the AP600. Therefore, OITS 2642/Q260.68 remained open.

In its December 6, 1996, response to the NRC, Westinghouse requested that the staff "provide more specific information regarding the comment to include use of 'soft' controls in this test abstract. While the term "soft" is not used in this abstract, the test methods do include the use of "soft" controls during testing of the plant control system hardware and software." The staff is continuing to evaluate Revision 13 of the SSAR, Chapter 14, and Westinghouse's response to this item. OITS 2642/Q260.68 remains open.

- OITS 2646/Q260.72: Chapter 14 - ITP. 14.2.8.1.81, Pressurizer Pressure and Level Control: The Test Method subsection does not include testing of signal selector and isolation devices. Westinghouse should revise this subsection to encompass testing of these devices or should identify the test abstract that encompasses such testing.

In its August 13, 1996, response to the NRC, Westinghouse stated that "The test abstract for the reactor coolant system in Subsection 14.2.9.1.1 specifies that the proper operation of the pressurizer pressure and level control is verified. Additional testing is also performed during the startup testing. Detailed methods for performing this verification, including signal selector and isolation devices, are to be included in the actual test procedures developed by the COL applicant."

In its November 8, 1996, response to Westinghouse, the staff found that the RAI's concern on testing of signal selector and isolation devices was not addressed in Subsection 14.2.9.1.1 or any other startup testing sections. The staff requested that Westinghouse either specify how the COL applicant can develop test procedures to cover those components, or modify the appropriate test abstracts to reflect these tests. Therefore, OITS 2646 remained open.

In its December 6, 1996, response to the NRC, Westinghouse stated that "Consolidated system level tests encompass multiple functions provided by integrated system assemblies. It is the intent that subsections (a) and (d) of Subsections 14.2.9.2.12, 'Plant Control System. . .' include testing of the signal selector, distributed controllers, process bus multiplexers, etc. as related to Pressurizer Pressure and Level Control as well as other significant PLS functions." The staff is continuing to evaluate Revision 13 of the SSAR, Chapter 14, and Westinghouse's response to this item. OITS 2646/Q260.72 remains open.

- OITS 2648/Q260.74: Chapter 14 - ITP, 14.2.8.2.46, Plant Control System: The scope of this test should be expanded to encompass all other Plant Control System subsystems as identified in SSAR Chapter 7.1. Alternatively, Westinghouse should identify the test abstracts that currently encompass such subsystems.

In its August 13, 1996, response to the NRC, Westinghouse stated that "The test abstract for the plant control system in Subsection 14.2.9.2.12 has been revised to include the control functions specified in SSAR Section 7.1"

In its November 8, 1996, response to Westinghouse, the staff found that Section 14.2.9.2.12 had not addressed all the control functions specified in the SSAR. Therefore, OITS 2648/Q260.72 remained open.

In its December 6, 1996, response to the NRC, Westinghouse stated that "The plant control systems functions to be tested are delineated in the two bullets under the Subsection 14.2.9.2.12 labeled 'Purpose' and

coincide with the functions listed in SSAR Section 7.1.3, first paragraph. While each function is not specifically mentioned in the General Test Methods and Acceptance Criteria of Subsection 14.2.9.2.12, the general test methods of paragraphs a), b), c), and d) apply to each function described above." The staff is continuing to evaluate Revision 13 of the SSAR, Chapter 14, and Westinghouse's response to this item. OITS 2648/Q260.74 remains open.

- ❑ OITS 2931/Q260.75 is closed. Closure of this item was documented in the staff's March 20, 1997, letter to Westinghouse.
- ❑ OITS 2932/Q260.76 is closed. Closure of this item was documented in the staff's March 20, 1997, letter to Westinghouse.
- ❑ OITS 5319/Q260.91: Westinghouse should demonstrate conformance with its commitment to RG 1.70, "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants (LWR Edition), Revision 3 November 1978, by providing the following:
  - a) As described in Subsections 14.2.3, "Test Procedures" and 14.2.4, "Conduct of Test Programs" of RG 1.70, SSAR Section 14.2.3, "Test Specifications and Test Procedures," or alternatively, Section 14.2.3.1, "Conduct of Test Program," should be revised to include a description of how organizations responsible for the design of the facility will participate in the establishment of performance requirements and acceptance criteria for testing plant structures, systems, and components and how such design organizations will interface with other participants involved in the test program. This description should also include the methods to be followed in initiating design modifications or maintenance activities that are determined to be required by the test program, including methods that will be used to ensure retesting following such modifications or maintenance activities and the involvement of the design organization and the Combined License (COL) applicant in the review and approval of proposed plant modifications.
  - b) As described in Subsection 14.2.5, "Review, Evaluation, and Approval of Test Results" of RG 1.70, SSAR Section 14.2.3.2, "Review of Test Results," should be revised to include a description of the measures to be established for the review, evaluation, and approval of test results for each major phase of the program. The specific controls to be established to ensure notification of affected and responsible organizations or personnel when test acceptance criteria are not met and the controls established to resolve such matters should also be described. A discussion should be provided on the COL applicant's plans pertaining to (1) approval of test data for each major test phase before proceeding to the next test phase and (2) approval of test data at each power test plateau (during the power-ascension phase) before increasing power level.



In its May 9, 1997, response Westinghouse addressed these items, as follows:

- a. Per the response to OITS 1236/DSER Open Item 14.2.2-2, Westinghouse has revised Section 14.2.3 to include the commitment that principal design organizations shall provide a scoping document that establishes performance requirements and acceptance criteria for testing the AP600 plant structures, systems, and components.

Section 14.4.4 has been revised to include the provisions for design modifications or maintenance activities that are determined to be required. This section currently addresses the role of the design organizations.

- b. SSAR Section 14.2.3.2 specifies that plant management shall define a process that considers appropriate hold points, review of test results, and resolution of failures to meet performance criteria. Section 14.4 specifies that the COL applicant shall conduct the test plan in accordance with 14.2.3.

The staff finds that Revision 13 to SSAR Sections 14.2.3 and 14.4.4 adequately address how organizations responsible for the design of the facility will participate in the establishment of performance requirements and acceptance criteria for testing plant structures, systems, and components, including treatment of unacceptable test results, and how such design organizations will interface with other participants involved in the test program. Therefore, OITS 5319/Q260.91 is closed.

- OITS 5320/Q260.92: Section 14.2.3.3, "Test Records", appears to contradict the test records retention provisions specified in RG 1.28, "Quality Assurance Program Requirements (Design and Construction)," Revision 3. Westinghouse should revise the text in this section in order to remain consistent with its commitment to RG 1.28, Revision 3.

In its May 9, 1997, response to the staff, Westinghouse proposed to modify Section 14.2.3.3 to state that retention of test records will be performed in accordance with RG 1.28.

The staff finds that Revision 13 to SSAR Section 14.2.3.3 acceptable. OITS 5320/Q260.92 is closed.

- OITS 5321/Q260.93: Section 14.2.5, "Utilization of Reactor Operating and Testing Experience in the Development of Test Program," states that "special tests" used to establish a unique performance parameter of the AP600 design that will not change from plant to plant are to be performed on the first plant only. Westinghouse should revise this section to include the following:

- a) Selection (screening) criteria used by Westinghouse to identify such special tests

- b) Provisions or programmatic controls that will be utilized by Westinghouse and/or the COL applicant to establish that system configuration or design engineering changes do not invalidate previous special test results.

In its May 9, 1997, response to the staff, Westinghouse addressed these issue as follows:

- a. The screening criteria that was used by Westinghouse as presented in Section 14.2.5 has been revised as follows:

Special tests to further establish a unique phenomenological performance parameter of the AP600 design features beyond the testing performed for Design Certification and that will not change from plant to plant, are performed for the first plant only. Because of the standardization of the AP600 design, these special tests (designated as first plant only tests) are not required on follow plants. These first plant only tests are identified in the individual test descriptions. (See Subsections 14.2.9 and 14.2.10.)

- b. This item is addressed by the provisions 10 CFR Part 52.47 which stipulates that changes to Tier 1 documentation requires new rulemaking, and that changes to Tier 2 will require a 50.59 type evaluation that will assess the impact to the SSAR including Chapter 14. Changes identified that impact these special tests will be identified, and tests may be modified or repeated as appropriate.

Based on this response, the staff finds the following:

- a. The revised criteria is not responsive to the staff request for a "screening" or selection criteria. Westinghouse should include clear, concise, and objective criteria that establishes the basis for designating first-plant-only tests. Alternatively, given that the number of first plant only tests is limited, Westinghouse could identify the individual tests in Section 14.2.5 and the associated justification for the first-plant-only designation. This approach would allow the staff to review and approve the justifications, as opposed to generic selection criteria that may be difficult to develop given the diversity of the systems involved and the parameters being tested.
- b. While the staff agrees a change to Tier 1 information would require rulemaking in accordance with the requirements of 10 CFR Part 52.47, "special tests" or first-plant-only test abstracts are, by definition, not part of the AP600 ITAAC, i.e., not Tier 1 information. Therefore, Westinghouse should describe in Section 14.2.5 of the SSAR how the control mechanisms for Tier 2 information would establish that system configuration or design engineering changes do not invalidate previous special test results. The issue here is not only control of changes, but verification that the design, construction, fabrication, and

operation of future plant systems are consistent with those of the prototype plant for which first plant only testing is proposed. Westinghouse should describe the general approach that is to be followed to ensure that future plant configurations are consistent with the design, construction, operation, and testing performed for the first plant.

On this bases, OITS 5321/Q260.93 remains open.

- OITS 5322/Q260.94: Section 14.2.9.1.1, "Reactor Coolant System Testing" should be modified to address the following:

- a) This section describes integrity and leakage testing of the system, but does not indicate how this testing is to be performed. Specifically, the methods described in the abstract do not indicate whether this testing includes calibration and operability verification of the plant leak detection systems in accordance with RG 1.68, Appendix A, Paragraph 1.j.(5). An earlier version of the AP600 ITP (Revision 1, dated January 13, 1994) included a leak detection test description for both pre-operational and startup plant modes. It should also be noted that the CESSAR System 80+ utilized a "Pre-core" and "Post-core" Reactor Coolant System Leak Rate Measurement. The AP600 SSAR Chapter 14 ITP should include a leak detection test description for pre- and post-fuel-load plant modes.
- b) Under "Purpose" section the third bullet should be modified as follows:
  - Measure process parameters required for safety-related actuation and safe shutdown as described in SSAR Sections 7.2, 7.3 and 7.4
- c) Under "Purpose" section add a new bullet as follows:
  - Verify safety-related interlocks as described in SSAR Section 7.6
- d) Under "General Test Methods and Acceptance Criteria" item (g) add three new bullets as follows:
  - Normal RHR isolation valve interlock
  - Passive RHR heat exchanger inlet isolation valve interlock
  - CMT cold leg balance line isolation valve interlock

In its May 9, 1997, response to the staff, Westinghouse addressed these items as follows:

- a. Item (e) in Subsection 14.2.9.1.1 has been revised to specify the method and acceptance criteria for determining that RCS identified and unidentified leakage is within prescribed limits as specified

in the TSs. A specified post-fuel load RCS leak test has not been included because RCS TSs require surveillances on RCS leakage throughout the startup tests once the fuel is loaded.

- b. Section 14.2.9.1.1 has been revised as suggested.
- c. The interlocks described in SSAR Section 7.6 are not tested as part of the RCS, but rather as part of the applicable system testing (i.e. PXS and RNS). These preoperational tests for these systems (RNS - 14.2.9.2.4, PXS - 14.2.9.1.3) have been revised to include this reference to SSAR Section 7.6
- d. See the response to item (c) above.

The staff finds that Revision 13 to SSAR has adequately incorporated the Westinghouse proposed revisions for items b. through d. which are acceptable, however, the resolution of item a. is related to OITS 1255 as follows:

- a. Item (e) of Revision 13 to SSAR Section 14.2.9.1.1 addresses high/low pressure interface valve leakage only. In addition, RCS leakage compliance with TSs is verified through use of plant leak detection systems and these systems should be tested. See OITS 1255/DSER Open Item 14.2.8.3-1, item 5.0 under "Power Ascension Testing."

Therefore, OITS 5322/Q260.94 remains open pending satisfactory resolution of OITS 1255/DSER Open Item 14.2.8.3-1, above.

- OITS 5323/Q260.95: Section 14.2.9.1.2, "Steam Generator System Testing," states that part of its purpose is to verify that the system can remove heat from the reactor coolant system. This abstract should be modified to demonstrate the heat removal capability of the turbine bypass valves and the atmospheric dump valves, or to show where such testing is demonstrated, per RG 1.68, Appendix A, 1.d.(1) and 1.d.(2).

In its May 9, 1997, response to the staff, Westinghouse stated that operability of these valves is tested in the preoperational tests of the steam generator system (14.2.9.1.2.a) and main steam system (14.2.9.2.1). Heat transfer performance is demonstrated during startup testing of the plant.

While the staff agrees that operability of the valves is tested during the cited pre-operational tests, these tests do not address the heat removal capability of the subject systems and components. Section 14.2.10.4.12 would appear to provide for adequate testing of the turbine bypass system. Additionally, it is likely that use of the steam generator ADVs will be necessary at some point during startup, however, there is no test that specifically measures or verifies ADV performance. This issue is also addressed in OITS 1255/DSER Open Item 14.2.8.3-1, item 5.1 under "Power Ascension Testing."



Based on the above, OITS 5323/Q260.95 remains open pending resolution of OITS 1255/DSER Open Item 14.2.8.3-1.

- OITS 5324/Q260.96: Section 14.2.9.1.6, "Main Control Room Emergency Habitability System Testing," should be modified to provide frequency of testing and toxic monitoring provision for VES.

In its May 9, 1997, response to the staff, Westinghouse stated that preoperational testing of the main control room emergency habitability system is performed once as part of the ITP for each plant. Frequency of subsequent testing is addressed as part of the inservice testing described in SSAR Section 6.4.5.2.

Toxic gas monitors are not required for the AP600 and as such are not included in the design. Therefore, testing for toxic gas monitoring is not required as part of this test abstract. If the COL applicant locates the plant at a site that requires toxic gas monitoring due to offsite toxic chemicals near the plant, the COL applicant is responsible for specifying the type and location on the plant of these monitors, as specified in Section 6.4.7.

The staff finds that Revision 13 to SSAR Sections 6.4.5.2 and 6.4.7 adequately address frequency of testing and toxic monitoring provisions for VES, respectively. Therefore, OITS 5324/Q260.96 is closed.

- OITS 5325/Q260.97: Section 14.2.9.1.12, "Protection and Safety Monitoring System (PMS) Testing," should be modified to address the following:

- a) Under "Purpose" section, it is stated that the test will also verify defense-in-depth functions described in SSAR Section 7.1 which includes:
- Provide data from the safety-related sensors to the plant control system.
  - Provide information to the data display and processing system.
  - Provide data to the monitor bus for use by other systems within the plant.

The above functions should be included in the "General Test Methods and Acceptance Criteria" section.

- b) Under "Prerequisites" section, it is stated that required cabinet field wiring is electrically isolated to prevent operation of components controlled by the PMS. Additional clarification should be provided with respect to "electrically isolated." The following issues should be considered:

- The test procedures should not require disconnecting wires, installing jumpers, or other similar modifications of the installed equipment.
  - Tests conducted should use only permanently installed test equipment.
- c) Item (j) of the "General Test Methods and Acceptance Criteria" should include a test to verify "Bypass and Inoperable Status" as part of PMS abnormal operating conditions verification.
- d) Item (l) of the "General Test Methods and Acceptance Criteria" should specify the inter-cabinet communication to be tested. This test will verify the acceptable performance of the isolated fiber-optic data communication link between the following:
- The integrated protection cabinets to and from the engineered safety features actuation cabinets.
  - The engineered safety features actuation cabinets to and from the protection logic cabinets.
  - The protection logic cabinets to and from the protection multiplexer cabinets.
- e) An item should be added to verify the bypass logic that allows the system to meet the single failure criterion with one or two channels bypassed for testing or maintenance as described in SSAR Section 7.1.2.10, "Fault Tolerance, Maintenance, Test and Bypass."
- f) An item of "Timing Requirement" should be added under the "General Test Methods and Acceptance Criteria". Digital system architecture should account for communication time between components of the system. The digital instrumentation loop often includes the sensor, transmitter, A/D converter, multiplexer, data communication equipment, demultiplexer, memory devices, controls and displays. Therefore, timing analysis should consider the entire loop.

In its May 9, 1997, response to the staff, Westinghouse proposed that Section 14.2.9.1.12, "Protection and Safety Monitoring System (PMS) Testing," be modified to address these comments as follows:

- a) Item (j) of the "General Test Methods and Acceptance Criteria" section was modified and Item (n) added to address the defense-in-depth functions listed under the "Purpose" section.
- b) The "Prerequisites" section was modified to address this item.
- c) Item (j) of the "General Test Methods and Acceptance Criteria" section was modified to clarify verification of abnormal operation status indications.

- d) Item (1) of the "General Test Methods and Acceptance Criteria" section was modified to specify the inter-cabinet communications to be tested.
- e) Items (b) and (e) of the "General Test Methods and Acceptance Criteria" section were modified to clarify that the bypass logic which allows the system to meet the single failure criteria is to be verified.
- f) Items (b) and (e) of the "General Test Methods and Acceptance Criteria" section were modified to clarify that the response times associated with the applicable trip/actuation functions are to be verified.

In Revision 13 to SSAR, Westinghouse modified Section 14.2.9.1.12 as described above. Therefore, OITS 5325/Q260.97 is closed.

- OITS 5326/Q260.98: Section 14.2.9.1.13, "Incore Instrumentation System Testing," should be modified to address the following:
  - a) As defined in SSAR Section 7.1, the primary function of the incore instrumentation system is to provide a three-dimensional flux map of the reactor core. This map is used to calibrate neutron detectors used by the protection and safety monitoring system, as well as to optimize core performance. A secondary function of the incore instrumentation system is to provide the protection and safety monitoring system with thermocouple signals necessary for the post-accident inadequate core cooling monitor. Therefore, the "Purpose" section of system testing should include these functions.
  - b) The "General Test Methods and Acceptance Criteria" should address tests to verify the functions of the Incore Instrumentation System stated in item a) above.

In its May 9, 1997, response to the staff, Westinghouse stated that to the extent practical, the operability of the incore instrumentation is verified during preoperational testing by performing continuity checks on the core exit thermocouples as specified in item (b). Operability of this instrumentation is verified during startup testing.

The staff determined that startup tests 14.2.10.1.7, 14.2.10.1.8, and 14.2.10.4.2 provide testing for incore instrumentation including performance of flux mapping. On this basis, OITS 5326/Q260.98 is closed.

- OITS 5327/Q260.99: Section 14.2.9.1.14, "Class 1E DC Power and Uninterruptable Power Supply Testing," and Section 14.2.9.2.16, "Non-Class 1E DC Power and Uninterruptable Power Supply Testing," should be modified to demonstrate testing of instrumentation and alarms, ground detection, and permissive and prohibitive interlocks per RG 1.68, Appendix A, 1.g.(4).

In its May 9, 1997, response to the staff, Westinghouse proposed that Section 14.2.9.1.14, "Class 1E DC Power and Uninterruptable Power Supply Testing," and Section 14.2.9.2.16, "Non-Class 1E DC Power and Uninterruptable Power Supply Testing," be modified to demonstrate testing of instrumentation and alarms, ground detection, and permissive and prohibitive interlocks.

The staff finds that the proposed revisions, as incorporated in Revision 13 to SSAR Sections 14.2.9.1.14 and 14.2.9.2.16, satisfy the provisions of RG 1.68, Appendix A, 1.g.(4). Therefore, OITS 5327/Q260.99 is closed.

- OITS 5328/Q260.100: Section 14.2.9.2.1, "Main Steam System Testing," should be modified to include testing of the turbine control and intercept valves as discussed in Attachment 3 to the Westinghouse letter of July 16, 1996, per RG 1.68, Appendix A, 1.e.(6).

In its May 9, 1997, response to the staff, Westinghouse stated that preoperational testing of the turbine control and intercept valves is performed as part of the Main Turbine System testing described in Section 14.2.9.4.3. This section would be modified to explicitly mention these valves.

The staff finds that the proposed revisions, as incorporated in Revision 13 to SSAR Sections 14.2.9.4.3, satisfy the provisions of RG 1.68, Appendix A, 1.e.(6). Therefore, OITS 5328/Q260.100 is closed.

- OITS 5329/Q260.101: Section 14.2.9.2.3, "Chemical and Volume Control System Testing," should be modified to reinstate testing of the purification and cleanup functions of the CVCS per RG 1.68, Appendix A, 1.n.(10).

In its May 9, 1997, response to the staff, Westinghouse stated that Section 14.2.9.2.3 would be modified to include testing of the purification and cleanup functions of the CVCS.

The staff finds that the proposed revisions, as incorporated in Revision 13 to SSAR Sections 14.2.9.4.3, satisfy the provisions of RG 1.68, Appendix A, 1.n.(10). Therefore, OITS 5329/Q260.101 is closed.

- OITS 5330/Q260.102: Section 14.2.9.2.7, "Spent Fuel Pool Cooling System Testing," should be modified to reinstate testing of the operability of gates and drains and to perform leak tests of gates, drains, and gaskets per RG 1.68, Appendix A, 1.m.(3).

In its May 9, 1997, response to the staff, Westinghouse stated that Section 14.2.9.2.7 would be modified to include testing of the operability of gates and drains and to perform leak tests of gates, drains, and gaskets.



The staff finds that the proposed revisions, as incorporated in Revision 13 to SSAR Sections 14.2.9.2.7, satisfy the provisions of RG 1.68, Appendix A, 1.m.(3). Therefore, OITS 5330/Q260.102 is closed.

- OITS 5331/Q260.103: Section 14.2.9.2.9, "Central Chilled Water System Testing," should be modified to include testing of the high capacity portion of the system.

In its May 9, 1997, response to the staff, Westinghouse stated that Section 14.2.9.2.9, would be modified to include testing of the high capacity portion of the system.

The staff finds the proposed revisions incorporated in Revision 13 to SSAR Sections 14.2.9.2.9 acceptable. Therefore, OITS 5331/Q260.103 is closed.

- OITS 5332/Q260.104: Section 14.2.9.2.10, "Nuclear Island Nonradioactive Ventilation System Testing," should be modified to provide frequency of testing and radiation and toxic monitoring provision for VES.

In its May 9, 1997, response to the staff, Westinghouse stated that Preoperational testing of the nuclear island nonradioactive ventilation system is performed once as part of the ITP for each plant. Frequency of subsequent testing is addressed as part of the inservice testing described in SSAR Section 6.4.5.2.

Toxic gas monitors are not required for the AP600 and as such are not included in the design. Therefore, testing for toxic gas monitoring is not required as part of this test abstract. If the COL applicant locates the plant at a site that requires toxic gas monitoring due to offsite toxic chemicals near the plant, the COL applicant is responsible for specifying the type and location on the plant of these monitors, as specified in Section 6.4.7.

The staff finds that Revision 13 to SSAR Sections 6.4.5.2 and 6.4.7 adequately address frequency of testing and toxic monitoring provisions for VES, respectively (See OITS 5324/Q260.96, above). Therefore, OITS 5332/Q260.104 is closed.

- OITS 5333/Q260.105: Section 14.2.9.2.13, "Data Display and Processing System Testing," should be modified to add an item regarding "Timing Requirement" under the "General Test Methods and Acceptance Criteria". Digital system architecture should account for communication time between components of the system. The digital instrumentation loop often includes the sensor, transmitter, A/D converter, multiplexer, data communication equipment, demultiplexer, memory devices, controls and displays. Therefore, timing analysis should consider the entire loop.

In its May 9, 1997, response to the staff, Westinghouse stated that Section 14.2.9.2.13, "Data Display and Processing System Testing," would

be modified by adding Item (c) under the "General Test Methods and Acceptance Criteria" to address response times associated with accessing information displays, display of data and display refresh rates.

The staff finds the proposed revisions incorporated in Revision 13 to SSAR Sections 14.2.9.2.13 acceptable. Therefore, OITS 5333/Q260.105 is closed.

- OITS 5334/Q260.106: Section 14.2.9.2.14, "Diverse Actuation System Testing," should be modified to address the following:

- a) The "General Test Methods and Acceptance Criteria" for automatic DAS actuation should be consistent with SSAR Section 7.7.1.11 description. The test method should define the actuation functions with the corresponding parameters. These actuation functions include the following:
  - Trip rods via the motor generator set, and trip turbine and initiate the passive residual heat removal on low wide range steam generator water level
  - Initiate passive residual heat removal on high hot leg temperature
  - Actuate the core makeup tanks, and trip the reactor coolant pumps on low pressurizer water level
  - Isolate critical containment penetrations and start passive containment cooling water flow on high containment temperature
- b) The "General Test Methods and Acceptance Criteria" should include a procedure to verify that diversity for DAS is achieved by the use of a different architecture, different hardware implementation and different software from that of the protection and safety monitoring system.
- c) The "General Test Methods and Acceptance Criteria" should include a procedure to verify the diverse indications for the following parameters:
  - Steam generator water level
  - Hot leg temperature
  - Core exit temperature
  - Pressurizer level
  - Containment temperature
  - Containment hydrogen concentration
- d) The "General Test Methods and Acceptance Criteria" should include a procedure to verify the DAS and the protection and safety monitoring system use independent and separate uninterruptable power supplies.

- e) The "General Test Methods and Acceptance Criteria" should include a procedure to verify that the DAS uses sensors that are separate from those used by the PMS and the plant control system.

In its May 9, 1997, response to staff, Westinghouse addressed these issue as follows:

- a) Tests of these automatic actuations are performed as part of the various individual system tests where automatic actuations and interlocks are verified. This is similar to the approach of testing the PMS and PLS automatic actuations.
- b) This type of verification is not consistent with the content of the ITP as discussed in RG 1.68. However, this verification is performed as part of the ITAACs as appropriate.
- c) Tests of this instrumentation are performed as part of the various individual system tests. This is similar to the approach of testing the instrumentation that interface with the PMS and PLS.
- d) This type of verification is not consistent with the content of the ITP as discussed in RG 1.68. However, this verification is performed as part of the ITAACs as appropriate.
- e) This type of verification is not consistent with the content of the ITP as discussed in RG 1.68. However, this verification is performed as part of the ITAACs as appropriate.

The staff finds the Westinghouse response acceptable. OITS 5334/Q260.106 is closed.

- OITS 5335/Q260.107: Section 14.2.9.2.15, "Main AC Power System Testing," is limited to testing of the diesel backed buses and associated load centers and motor control centers. Testing of the normal AC power distribution system in accordance with RG 1.68, Appendix A, Paragraph 1.g.(1) is not addressed in that electrical system performance, including interlocks, protective devices, initiating devices, transfer devices, relays, logic and other elements of the normal and preferred AC power system are not tested upstream of the diesel backed buses.

In its May 9, 1997, response to the staff, Westinghouse stated that Section 14.2.9.2.15 would be revised to address this comment.

The staff finds the proposed revisions incorporated in Revision 13 to SSAR Sections 14.2.9.2.15 acceptable. Therefore, OITS 5335/Q260.107 is closed.

- OITS 5336/Q260.108: Section 14.2.9.2.17, "Diesel Generator Testing," should be modified to address the following:

- a) The abstract should include a reference to Section 9.4.10 for appropriate design criteria related to the diesel ventilation systems (GTM&AC Item f).
- b) The abstract should reinstate that the proper automatic restart of the diesel is to be tested *immediately* following the load test (GTM&AC Item k) per RG 1.108, C.2.a.(5).
- c) The abstract should reinstate appropriate start tests per RG 1.108, C.2.a.(9).
- d) The abstract should include the statement: "Demonstrate by performing a loaded run of the diesel generator with its day tank filled to its low level alarm point, that the day tank provides sufficient fuel for at least 2 hours of diesel generator operation with the diesel generator supplying its expected power requirements."

In its May 9, 1997, response to the staff, Westinghouse addressed these issues as follows:

- a. The reference to Section 9.4.10 has been added as requested.
- b. RG 1.108 provides requirements for testing safety-related emergency diesel generators. The AP600 diesel generators are not safety-related, and are not required to be tested as specified.
- c. Same as b., above.
- d. This test is not required to be performed and is not necessary to verify the proper operation of the diesel generators.

While the staff acknowledges that Westinghouse has taken exception to RG 1.108 in Appendix 1A to the SSAR, the acceptability of this response is being evaluated against the regulatory and safety significance of the diesels in the AP600 design. OITS 5336/Q260.108 remains open.

- OITS 5337/Q260.109: Section 14.2.9.2.19, "Plant Lighting System Testing," is limited to testing of the main control room and remote shutdown station emergency lighting systems. As described in SSAR Section 9.5.3, emergency lighting is also provided for emergency ingress and egress, equipment areas associated with power recovery actions (e.g., diesel building), as well as for manual equipment actions in the event of a fire with loss of normal lighting. These self-contained lighting units support safe shutdown operations and should be included in the pre-operational testing to verify performance and proper positioning.

In its May 9, 1997, response to staff, Westinghouse stated that Section 14.2.9.2.19 would be revised to incorporate this comment.

The staff finds that Revision 13 to Section 14.2.9.2.19 does not address testing of self-contained emergency lighting units that provide lighting for emergency operations outside the control room such as power recovery



and manual/local operation of equipment during a fire, as described in SSAR Section 9.5.3.2.2. Therefore, OITS 5337/Q260.109 remains open.

- OITS 5338/Q260.110: Section 14.2.9.2.20, "Primary Sampling System Testing," should be modified to test laboratory equipment used to analyze or measure radiation levels and radioactivity concentrations per RG 1.68, Appendix A, 1.k.(3).

In its May 9, 1997, response to staff, Westinghouse stated that Section 14.2.9.2.20 would be revised to test laboratory equipment used to analyze or measure radiation levels.

The staff finds that the proposed revisions, as incorporated in Revision 13 to SSAR Sections 14.2.9.2.20, satisfy the provisions of RG 1.68, Appendix A, 1.k.(3). Therefore, OITS 5338/Q260.110 is closed.

- OITS 5339/Q260.111: Section 14.2.9.3.3, "Solid Radwaste System Testing," should be modified to verify that no free liquids are present in the packaged wastes per RG 1.68, Appendix A, 1.l.(3).

In its May 9, 1997, response to staff, Westinghouse stated that packaging of solid radwaste is the responsibility of the COL applicant and is identified in SSAR Table 1.8-1 under item 11.3.

The staff finds this response unacceptable. While the staff acknowledges that packaging of solid radwaste is the responsibility of the COL applicant, such responsibility does not exempt the COL applicant or its designee from having to conduct testing as described in SSAR Section 14.2.9.3.3 in accordance with RG 1.68. Therefore, Westinghouse should modify Section 14.2.9.3.3 to include verification that no free liquids are present in the packaged wastes per RG 1.68, Appendix A, 1.l.(3), or provide an acceptable alternative. OITS 5339/Q260.111 remains open.

- OITS 5340/Q260.112: Section 14.2.9.3.4, "Radioactive Waste Drain System Testing," should be revised to address the following:

- a) Section 9.3.5 should be added as a reference in the Purpose and General Test Acceptance Criteria and Methods sections.
- b) The following statement should be added: "Flow water in each drain path to verify that the drains discharge to their designated destination and that system segregation is maintained."

In its May 9, 1997, response to the staff, Westinghouse stated that Section 14.2.9.3.4, "Radioactive Waste Drain System Testing," would be revised as appropriate. Westinghouse also noted that system segregation is not a design feature of the AP600 Radioactive Waste Drain System Testing.

The staff finds the proposed revisions incorporated in Revision 13 to SSAR Sections 14.2.9.3.4 acceptable. However, further staff review is needed with regards to system segregation as an AP600 design feature. Therefore, this portion of OITS 5340/Q260.112 remains open.

- OITS 5341/Q260.113: Section 14.2.9.3.6, "Waste Water System Testing," should be revised to address the following:
  - a) Section 9.2.9 should be added as a reference in the Purpose and General Test Acceptance Criteria and Methods sections.
  - b) The following statement should be added: "Verify the ability of the turbine building drain tanks to provide an alarm and trip the drain tank pumps and the waste water retention basin pumps on detection of radiation in the drain tanks."

In its May 9, 1997, response to the staff, Westinghouse stated that Section 14.2.9.3.6, "Waste Water System Testing," would be revised as requested.

The staff finds the proposed revisions incorporated in Revision 13 to SSAR Sections 14.2.9.3.6 acceptable. Therefore, OITS 5341/Q260.113 is closed.

- OITS 5342/Q260.114: Section 14.2.9.4.6, "Circulating Water System Testing," should be modified to include testing of cooling towers and associated auxiliaries as discussed in Attachment 3 to the Westinghouse letter of July 16, 1996, per RG 1.68, Appendix A, 1.f.(2).

In its May 9, 1997, response to the staff, Westinghouse stated that the circulating water system cooling towers are not part of the scope of the AP600 Design Certification submittal. They have been addressed in the response to OITS 1257/DSER Open Item 14.2.9-1.

Based on the above, OITS 5342/Q260.114 remains open pending satisfactory resolution of OITS 1257/DSER Open Item 14.2.9-1.

- OITS 5343/Q260.115: Section 14.2.9.4.12, "Containment Air Filtration System Testing," should be revised to specifically include testing of the system filters, consistent with the testing described for other ventilation systems.

In its May 9, 1997, response to the staff, Westinghouse stated that Section 14.2.9.4.12, "Containment Air Filtration System Testing," would be revised to specifically include testing of the system filters, consistent with the testing described for other ventilation systems.

The staff finds the proposed revisions incorporated in Revision 13 to SSAR Sections 14.2.9.4.12 acceptable. Therefore, OITS 5343/Q260.115 is closed.

- ❑ OITS 5344/Q260.116: Section 14.2.9.4.14, "Mechanical Handling System Crane Testing," describes testing of the reactor building polar crane and other hoists. The test abstract does not address testing of the auxiliary building cranes, including the jib and cask cranes, in accordance with RG 1.68, Appendix A, Paragraphs, 1.m.(2), 1.m.(4), and 1.o.(1). In addition, the term "reactor building polar crane" is inconsistent with the "containment polar crane" terminology in SSAR Section 9.1.

In its May 9, 1997, response to the staff, Westinghouse stated that Section 14.2.9.4.14 would be modified to specifically reference the cranes and hoists specified as part of the Mechanical Handling System. In addition, testing conducted in the Fuel Handling and Reactor Component Servicing Equipment Test (14.1.9.1.15) addresses the items 1.m.(2), 1.m.(4), and 1.o.(1).

The staff finds the proposed revisions incorporated in Revision 13 to SSAR Sections 14.2.9.4.14 acceptable. Therefore, OITS 5344/Q260.116 is closed.

- ❑ OITS 5345/Q260.117: Section 14.2.9.4.15, "Seismic Monitoring System Testing," should be modified to address the following issue. SSAR Section 3.7.4.2 states that the solid-state recording and analysis system has internal batteries and charger to prevent the loss of data during a power outage, and to allow data collection and analysis in a seismic event during which power fails. The "General Test Methods and Acceptance Criteria" should include a procedure to simulate power outage and to verify the system response as stated in the SSAR.

In its May 9, 1997, response to the staff, Westinghouse stated that Section 14.2.9.4.15, "Seismic Monitoring System Testing," would be modified to address this issue as requested.

The staff finds the proposed revisions incorporated in Revision 13 to SSAR Sections 14.2.9.4.15 acceptable. Therefore, OITS 5345/Q260.117 is closed.

- ❑ OITS 5296/Q260.118: The following is a general comment on Section 14.2.9.1.4. The purpose of the testing in this section is stated in terms of the safety-related function "to transfer heat from inside containment to the environment".

Additional testing objectives need to be incorporated into the ITP to validate the expected PCS wetting characteristics. Additional testing objectives need to be incorporated into the ITP to validate the overall heat transfer characteristics used in the design basis accident evaluation model which are dependent on the as-built structures. (RAIs 260.119 through 260.130 are specific examples of the above general comment).

In its June 11, 1997, response to the staff, Westinghouse stated that the response to RAIs 260.119 through 260.130 address the specific aspects of this general comment.

The staff agrees that this general RAI is addressed by individual RAIs 260.119 - 260.130. On this basis, OITS 5296/Q260.118 is closed.

- OITS 5297/Q260.119: The testing purpose of 14.2.9.1.4 needs to be expanded. It needs to be clear that there are distinct periods (three) of flow which need to be evaluated as well as the period of performance, 72 hours.

In its June 11, 1997, response to the staff, Westinghouse stated that [14.2.9.1.4] Item (c) has been clarified to state that testing will be conducted to cover the entire range of expected PCCS flow rates.

The staff finds the proposed revisions incorporated in Revision 13 to SSAR Section 14.2.9.1.4 acceptable. Therefore, OITS 5297/Q260.119 is closed.

- OITS 5298/Q260.120: The passive containment cooling system water storage tank (PCCWST) is now also used as a safety-related makeup source for the spent fuel pool (see SSAR Section 6.2.2, Revision 11, February 28, 1997, page 6.2-21). This should be stated under Purpose, as is the fire protection function. Also, the description of the new, isolated fire protection tank within the PCCWST should be provided. Appropriate testing for the spent fuel pool makeup function needs to be developed and referenced in the ITP.

In its June 11, 1997, response to the staff, Westinghouse stated that testing of the passive containment cooling system, spent fuel pool cooling, and long-term safety system support has been modified to appropriately reflect the new NRC criteria regarding post-72 hour operations. Sections 14.2.9.1.4, 14.2.9.2.7, and 14.2.9.1.16, Passive Containment Cooling System Testing, Spent Fuel Pool Cooling System Testing, and Long-Term Safety System Support Testing would be revised accordingly.

The staff finds the proposed revisions incorporated in Revision 13 to SSAR Sections 14.2.9.1.4, 14.2.9.2.7, and 14.2.9.1.16 acceptable. Therefore, OITS 5298/Q260.120 is closed.

- OITS 5299/Q260.121: Under prerequisites [14.2.9.1.4], the quantity of water available in the PCCWST needs to reflect an amount sufficient to demonstrate that at the minimum level (volume) specified in the TSs, the PCS will provide at least 72 hours of continuous cooling water.

In its June 11, 1997, response to the staff, Westinghouse stated that the prerequisites state the requirements for the ability to fill the tank. [14.2.9.1.4] Item (c) of the passive containment cooling system testing will be modified to include a test to show that the tank has sufficient capacity to last 72 hours.

The staff finds the proposed revisions incorporated in Revision 13 to SSAR Section 14.2.9.1.4 acceptable. Therefore, OITS 5299/Q260.121 is closed.



- OITS 5300/Q260.122: Under General Test Acceptance Criteria and Methods [14.2.9.1.4], the reference to Section 6.2 should be limited to Section 6.2.2, "Passive Containment Cooling System," only. This test does not cover the other sections.

In its June 11, 1997, response to the staff, Westinghouse stated that the comment would be incorporated.

The staff finds the proposed revisions incorporated in Revision 13 to SSAR Section 14.2.9.1.4 acceptable. Therefore, OITS 5300/Q260.122 is closed.

- OITS 5301/Q260.123: Under General Test Acceptance Criteria and Methods [14.2.9.1.4], the reference to "appropriate design specifications" is unacceptable. SSAR Section 6.2.2, specifically Section 6.2.2.2.4, "System Operation," needs to identify the relevant design specifications which are directly verified by test. At a minimum these include, for each flow phase:

- a. The minimum acceptable flow rate for each flow phase, as measured just prior to the uncover of each stand pipe.
- b. The minimum acceptable water coverage area on the vessel side wall near the upper annulus drain elevation for each flow phase, and the uniformity of the coverage around the circumference of the vessel.
- c. The time period for each flow phase, which considers the design objective of providing cooling water for a period of at least 72 hours in three flow phases to account for the reduction in the amount of heat to be removed during each phase.

In its June 11, 1997, response to the staff, Westinghouse stated the following:

As Section 14.3 requires the AP600 design team to provide a scoping document that defines the applicable design requirements that must be validated, the use of "relevant" or "applicable" design specifications for a reference for more detailed design criteria for the acceptability of preoperational testing is warranted and has precedence in earlier standard submittals (i.e. CESSAR System 80+ and GE ABWR). [The following changes would be reflected in Revision 13 to the SSAR:]

- a. SSAR Section 6.2.2 has been modified to include these flow rates.
- b. SSAR Section 6.2.2 has been modified to specify the minimum acceptable coverage under the third phase of operation.
- c. SSAR Section 6.2.2 has been modified to include the flow profile for PCS operation which will provide the timing information requested.

The staff finds the proposed revisions incorporated in Revision 13 to SSAR Section 6.2.2 acceptable. Therefore, OITS 5301/Q260.123 is closed.

- OITS 5302/Q260.124: Heat removal requires an adequate water film on the vessel exterior surface (sufficiently thick to assure stability based on the design basis accident evaluation model), as noted in SSAR Section 6.2.2.2.4. A non-invasive method for approximating the film thickness during each flow phase needs to be included in the ITP. Based on the known water delivery flow rate and the water coverage area, near the upper annulus drains, a method which measures the time for "a water particle" to travel from the vessel spring line to the upper annulus drain can be used to estimate the average film thickness over the covered vessel side wall.

In its June 11, 1997, response to the staff, Westinghouse stated that the key parameters associated with proper PCS operation are total water flow and containment surface area coverage, which are thoroughly tested for as part of the ITP. Provided that these parameters can be verified, the actual water film thickness need not be tested.

The staff finds Westinghouse's response satisfactory. Therefore, OITS 5302/Q260.124 is closed.

- OITS 5303/Q260.125: Under General Test Acceptance Criteria and Methods [14.2.9.1.4], c), references to item a. and c. under RAI 260.123 need to be incorporated.

In its June 11, 1997, response to the staff, Westinghouse stated that the responses to Items 260.119 and 260.123 address this issue.

The staff finds Westinghouse's response satisfactory. Therefore, OITS 5303/Q260.125 is closed.

- OITS 5304/Q260.126: Under General Test Acceptance Criteria and Methods [14.2.9.1.4], c), the text refers to the PCCWST "drain" flowpath. SSAR Section 6.2.2 refers to the PCCWST "outlet" piping or "discharge" piping. In other descriptions, for example the TSs, references are made to the PCCWST "delivery" flowpath [piping]. There needs to be one term which is consistently used to identify the PCS piping which provides the cooling water to the distribution bucket.

In its June 11, 1997, response to the staff, Westinghouse stated that the SSAR Section 14.2.9.1.4 would be revised to use the term "delivery flowpath" to refer to the PCCWST discharge piping.

The staff finds the proposed revisions incorporated in Revision 13 to SSAR Section 14.2.9.1.4 acceptable. Therefore, OITS 5304/Q260.126 is closed.

- OITS 5305/Q260.127: Under General Test Acceptance Criteria and Methods [14.2.9.1.4], d), reference to item b. under RAI 260.123 needs to be incorporated.

In its June 11, 1997, response to the staff, Westinghouse stated that this comment will be incorporated, consistent with the response to RAI 260.123.

The staff finds Westinghouse's response satisfactory. Therefore, OITS 5305/Q260.127 is closed.

- ❑ OITS 5306/Q260.128: Under General Test Acceptance Criteria and Methods [14.2.9.1.4], d), in addition to verifying the uniformity of the wetted surface (proper operation of the water distribution bucket and weirs), an estimation of the water film thickness needs to be incorporated, as discussed in RAI 260.124.

In its June 11, 1997, response to the staff, Westinghouse stated that this issue is addressed in its response to RAI 260.124.

The staff finds Westinghouse's response satisfactory. Therefore, OITS 5306/Q260.128 is closed.

- ❑ OITS 5307/Q260.129: Under General Test Acceptance Criteria and Methods [14.2.9.1.4], b), reference is made to features and equipment not identified in Section 6.2.2 of the SSAR. These features need to be included in the SSAR description:

- a. Diverse actuation signals, those in addition to the Hi-2 containment pressure signal, need to be included in SSAR Section 6.2.2.1. Alternatively, the ITP description would have to specifically address SSAR Section 7.3 to identify the appropriate features of the PCS actuation system that are covered by the testing.
- b. The shield plate which protects the distribution bucket.

In its June 11, 1997, response to the staff, Westinghouse stated the following:

- a. Item (b) of test Abstract 14.9.2.1.4 would be revised to address the testing of system interlocks including PMS and DAS. References to these SSAR sections will be incorporated.
- b. The shield plate does not perform a passive containment cooling system function and therefore is not discussed in Section 6.2. This plate serves as a shield for radiation from the containment and is shown in the general arrangement drawings in Section 1.2 and will be shown in Figure 3.8.4-7 in the Revision 14 issue of the SSAR.

The staff finds the Westinghouse response acceptable based on the following:

- a. Revision 13 to Section 14.2.9.1.4 references SSAR Sections 7.3 and 7.5 for PCCS instrumentation and controls.

b. The proposed changes to SSAR Figure 3.8.4-7 do not impact the ITP.

Therefore, OITS 5307/Q260.129 is closed.

- OITS 5308/Q260.130: An additional test objective [in 14.2.9.1.4] needs to be developed that will provide an estimate of the overall heat transfer process during the testing of the PCS. Consideration should be given to performing the test with a sufficient temperature difference between the PCCWST water temperature and the internal containment temperature to observe and measure containment cooldown. With no steam inside containment, this test will validate the overall thermal resistance of the vessel wall and its inorganic zinc coatings used in the design basis accident evaluation model. These data should, if practical, be obtained in conjunction with General Test Acceptance Criteria and Methods, which provides information on the exterior boundary of the PCS (air flow rates and temperatures).

In its June 11, 1997, response to the staff, Westinghouse stated that an additional test would be incorporated [in Revision 13 to the SSAR] to require sample coupons from the containment shell to be laboratory tested to determine its conductivity with and without an appropriate coating of paint.

The staff finds the provisions for testing containment materials to verify the heat conductivity of the containment structure incorporated in Revision 13 to SSAR Section 14.2.9.1.4 acceptable. Therefore, OITS 5308/Q260.130 is closed.

- OITS 5309/Q260.131: Is the preoperational test in 14.2.9.1.10 separate and distinct from the ASME Containment Structural Acceptance Test? Is it performed after the ASME Containment Structural Acceptance Test? If this is the case, it should be clarified in Section 14.2.9.1.10.

In its June 11, 1997, response to the staff, Westinghouse stated that Section 14.2.9.1.10 would be clarified. The ASME Containment Structural Acceptance Test specified in Section 3.8.2.7 is a construction test and is separate from the testing specified in this section.

The staff finds the proposed revisions incorporated in Revision 13 to SSAR Section 14.2.9.1.10 acceptable. Therefore, OITS 5309/Q260.131 is closed.

- OITS 5310/Q260.132: A requirement to verify that isolation valve divisional assignments for instrumentation and actuation circuits are correct should be included [in 14.2.9.1.10]. Also, instrumentation logic and remote manual operation capability should be verified.

In its June 11, 1997, response to the staff, Westinghouse stated that verification that isolation valve divisional assignments for instrumentation and actuation circuits are correct is included under Section 14.2.9.1.14 Class 1E DC Power and Uninterruptable Power Supply Testing.



The staff finds that Section 14.2.9.1.14 provides for divisional testing of power supplies only. However, Passive Containment Cooling System valves and controls are tested under 14.2.9.1.4, Containment isolation is tested under 14.2.9.1.10; and instrumentation logic is tested in Section 14.2.9.1.12. On this basis, OITS 5310/Q260.132 is closed.

- OITS 5311/Q260.133: Fail-open and fail-close valve motions should be verified [in 14.2.9.1.10].

In its June 11, 1997, response to the staff, Westinghouse stated that this testing is performed under [14.2.9.1.10] item (a). Inservice testing requirements include fail-safe testing of safety-related valves.

The staff finds that proper valve operation is verified by the tests in Section 14.2.9.1.4(a), which references SSAR Section 3.9.6 for testing criteria. SSAR Section 3.9.6 includes provisions for testing fail-safe positions of valves. On this basis, OITS 5311/Q260.133 is closed.

- OITS 5312/Q260.134: Stroke-times should be verified [in 14.2.9.1.10].

In its June 11, 1997, response to the staff, Westinghouse stated that this testing is performed under [14.2.9.1.10] item (a). Inservice testing requirements include stroke testing of safety-related valves.

The staff finds that proper valve operation is verified by the tests in Section 14.2.9.1.4(a), which references SSAR Section 3.9.6 for testing criteria. SSAR Section 3.9.6 includes provisions for testing fail-safe positions of valves. On this basis, OITS 5312/Q260.134 is closed.

- OITS 5313/Q260.135: Plants have used their Type C test procedures for preoperational testing. The test Abstract [14.2.9.1.10] references ANS-56.8-1994, for leakage testing methodology. The 1994 standard is permitted for Option B leakage testing programs to meet the requirements of Appendix J. Option A plants that want to use their Appendix J procedures and methods for preoperational testing have to use the 1972 standard.

In its June 11, 1997, response to the staff, Westinghouse stated that this comment would be incorporated in Revision 13 to the SSAR.

The staff finds that Revision 13 to Section 14.2.9.1.10 allows either leakage test standard as appropriate, depending on the selected leak test option. Therefore, OITS 5313/Q260.135 is closed.

- OITS 5314/Q260.136: The Purpose and the General Test Acceptance Criteria and Methods sections of 14.2.9.1.11 do not address the nonsafety-related functions described in Section 6.2.4. Specifically, those aspects of the system that have been incorporated to meet the requirements of 10 CFR 50.34(f)(2)(ix) need to be verified by testing. Therefore, this test abstract needs to be modified to include testing that verifies the operability of (1) all sixteen hydrogen sensors in

their role of supporting proper actuation and operation of the hydrogen igniters, and (2) the alternative power supplies to the hydrogen igniters.

In its June 11, 1997, response to the staff, Westinghouse stated that this comment would be incorporated in Revision 13 to SSAR Section 14.2.9.1.11.

The staff finds the proposed revisions incorporated in Revision 13 to SSAR Section 14.2.9.1.11 acceptable. Therefore, OITS 5314/Q260.136 is closed.

- OITS 5315/Q260.137: The SSAR does not appear to describe when the hydrogen igniters are to be actuated and how they are to be operated. This information is needed to support [14.2.9.1.11] test c) under General Test Acceptance Criteria and Methods.

In its June 11, 1997, response to the staff, Westinghouse stated that this comment would be incorporated in Revision 13 to SSAR Section 14.2.9.1.11.

The staff finds the proposed revisions incorporated in Revision 13 to SSAR Section 14.2.9.1.11 acceptable. Therefore, OITS 5315/Q260.137 is closed.

- OITS 5316/Q260.138: All the recombiner plates should be tested under [14.2.9.1.11] test b) of the General Test Acceptance Criteria and Methods unless it can be established that they are from the same batch or manufacturing lot. Westinghouse also needs to specify how many plates will be tested once traceability to the same batch or manufacturing lot has been established.

In its June 11, 1997, response to the staff, Westinghouse stated that a response to this item is still being prepared.

Therefore, pending receipt and evaluation of a response, OITS 5316/Q260.138 remains open.

- OITS 5317/Q260.139: Section 6.2.4 of the SSAR does not support the determination of a specified plate temperature as described in [14.2.9.1.11] test b) of the General Test Acceptance Criteria and Methods. Temperatures within the PAR cartridge can vary greatly and are dependent on a number of factors such as location and mounting of the thermocouple, and the proximity of the thermocouple to the hydrogen source. This information is needed because during a test the temperature within a plate may be below or above the specified acceptance temperature depending on the location of the thermocouple.

In its June 11, 1997, response to the staff, Westinghouse stated that a response to this item is still being prepared.

Therefore, pending receipt and evaluation of a response, OITS 5317/Q260.139 remains open.